

DOCUMENTED
BRIEFING

The Strategic Distribution System in Support of Operation Enduring Freedom

MARC ROBBINS, PATRICIA BOREN,
KRISTIN LEUSCHNER



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PREFACE

This documented briefing reports on research done as part of the Strategic Distribution program (SD), a joint endeavor of the U.S. Transportation Command (TRANSCOM) and the Defense Logistics Agency (DLA) to improve the reliability and responsiveness of the Defense distribution system.¹ This analysis is part of RAND's ongoing efforts to help these organizations shape the concept and strategy behind SD, and to aid in implementing process improvements.

SD began in 2000 as a means of addressing problems in the distribution portion of the military supply chain. Since the effort began, SD has produced a process improvement methodology that has resulted in distribution processes that move materiel and personnel more quickly, reliably, and efficiently.

Earlier initiatives such as the Army's Velocity Management (VM) had already demonstrated the successes that can result from a systematic analysis of end-to-end processes and the empowerment of a committed team of military logisticians. SD has extended these process improvements to the joint level. During its first year, SD laid the groundwork for major change. It established an organization to pursue improvement, developed measurement tools to capture successes and failures, and developed its strategic concept, headed by senior leaders from DLA and TRANSCOM. Committees were established to oversee SD efforts in four areas: stock positioning, air distribution, surface distribution, and financial management within the Defense Transportation System (DTS). These committees are led by senior officers from the DLA Defense Distribution Center (DDC), Air Force Air Mobility Command (AMC), TRANSCOM's Military Surface Deployment and Distribution Command (MSDDC), and TRANSCOM, respectively. An executive agent, two co-directors, and a common analytical agency coordinate complementary efforts and initiatives among the four committees. RAND supports each of the committees and provides conceptual analytical support to the overall leaders of SD.

This document presents the multifaceted story of SD, explaining why a significant change was needed in Defense distribution, how SD sought to

¹Previous to May 2002, SD was known as the Strategic Distribution Management Initiative (SDMI).

transform the system, and how well that system met the challenge of Operation Enduring Freedom (OEF) in 2001. It is based on a briefing prepared for the RAND Board of Trustees and presented at RAND's Washington, D.C. office on April 11, 2002.

This research is being conducted for TRANSCOM and DLA jointly within the Forces and Resources Policy Center of RAND's National Defense Research Institute (NDRI) and the Military Logistics Program of RAND's Arroyo Center. NDRI and the Arroyo Center are both federally funded research and development centers (FFRDCs) sponsored, respectively, by the Office of the Secretary of Defense (OSD), the Joint Staff, the unified commands, and the defense agencies; and by the United States Army.

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RAND routinely reviews and refines its quality assurance process and also conducts periodic external and internal reviews of the quality of its body of work. For additional details regarding the RAND quality assurance process, visit <http://www.rand.org/standards/>.

SUMMARY

In a tale of war the reader's mind is filled with the fighting. The battle . . . excites imagination and commands attention. . . . The long trailing line of communications is unnoticed. . . . Victory is the beautiful, bright-colored flower. Transport is the stem without which it could never have blossomed. Yet even the military student, in his zeal to master the fascinating combinations of the actual conflict, often forgets the far more intricate complications of supply . . . In savage warfare in a flat country the power of modern machinery is such that flesh and blood can scarcely prevail, and the chances of battle are reduced to a minimum. Fighting the Dervishes was primarily a matter of transport. The Khalifa was conquered on the railway.²

The Defense distribution system is the part of the Department of Defense (DoD) that manages the storage and movement of supplies to military customers at home and around the world. Unfortunately, throughout the 1990s, the system's performance was often poor and unreliable, and customers were losing confidence in it. As a result, in early 2000, leaders of the U.S. Transportation Command (TRANSCOM) and the Defense Logistics Agency (DLA) agreed to embark jointly on the Strategic Distribution program (SD) to deliver more reliable and cost-effective service to DoD forces and organizations in the United States and around the globe.³ This documented briefing tells the story of SD's inception and achievements, focusing in particular on how well that system met the challenge of Operation Enduring Freedom (OEF).

AFTER THE COLD WAR, PROBLEMS IN DEFENSE DISTRIBUTION BECAME APPARENT

Support to the Persian Gulf in 1990 during Operation Desert Storm provides an example of the kinds of problems facing the Defense distribution system throughout the 1990s. Although combat performance in this operation has been justifiably esteemed, there were significant problems in logistics support for the war. Distribution times were long, variable, and undependable, due largely to inefficient processes, clogged ports, and a myriad of other problems. The result

²Winston S. Churchill, *The River War: An Account of the Reconquest of the Soudan*, New York: Carroll and Graf Publishers, 2000 (originally published 1902), pp. 162-163.

³Before May 2002, SD was known as the Strategic Distribution Management Initiative (SDMI).

was that materiel often took more than 35 days simply to get out of the United States. Problems with the global distribution system persisted throughout the 1990s, despite individual service-specific successes (e.g., the Army's Velocity Management Initiative, the Air Force's Lean Logistics, and the Marine Corps' Precision Logistics).

The Defense distribution system was not structured to meet the needs of its customers effectively or efficiently. Inventory was scattered at dozens of locations in the United States and around the world, effectively making each supply point a "worldwide distributor" and removing the benefits of economies of scale. Whereas the best distribution practices emphasize streamlined flows and a minimization of stops, queues, and handling, Defense distribution modes tended to suffer from significant delays as materiel sat in ports and transit hubs. The unreliability of the military service caused many customers to turn to better—and more expensive—distribution modes, such as FedEx and Worldwide Express. Decreasing customer confidence was especially a problem for military air. The loss of customers contributed to the underuse of military air cargo capacity and caused reverberations for the wartime readiness of air crews and ground elements, which rely on peacetime missions (and the funds they bring in) to support their wartime training.

THE GOAL OF SD IS FAST, RELIABLE, COST-EFFECTIVE SUPPORT TO CUSTOMERS IN PEACE AND WAR

It was these disturbing trends that led leaders of TRANSCOM and DLA to join forces in 2000 to seek improvements, with RAND's assistance. The result of this collaboration, SD, builds upon RAND's similar efforts for the Army's Velocity Management (VM) initiative. Like VM, SD was founded on the principle of partnership among stakeholders and process owners. As in VM, RAND is playing a central role in making the case for change, assembling and integrating data to provide a comprehensive view of processes, and using those data to build metrics, reports, and analytical products to support improvement efforts. One of RAND's contributions to the SD effort has been a DoD-wide "distribution enterprise" database. This database provides a means of looking comprehensively into the performance of DoD's many distribution modes, including commercial services as well as military air distribution.⁴

⁴SD's focus, and that of the "distribution enterprise" database, is "sustainment" materiel requisitioned through the wholesale system. It does not cover deployments or materiel

One of the major challenges for the Defense distribution system is to provide fast, reliable, cost-effective support to customers despite the unpredictability and volatility of customer demand, which can surge or decline tremendously from one year to the next. To meet this challenge, SD has adopted a strategic vision built around what are known as the “3 S’s” – stock positioning, scheduled movements, and synchronization. Stock positioning means putting inventory in the right place; for example, within the United States, SD seeks to maximize the amount of cargo at two Strategic Distribution Platforms located, respectively, on the East and West Coasts. Scheduled movements from these distribution centers ensure that trucks leave at a certain time each day and arrive at their destination at a set time. Further, these steps are synchronized to minimize queuing and hold times – all the non-value-adding elements that make performance slow and unreliable.

SD’s initial efforts have yielded positive results, including the consolidation of inventory at the East Coast and West Coast U.S. locations, the expansion of stock points closer to customers in Europe, and the establishment of new customers and routes for scheduled trucks. These improvements will yield savings to taxpayers as well as better service to forces. DLA estimates that these actions will save at least \$120 million over the five-year period 2003–2007. In addition, improved military air distribution is matching commercial performance. A two-part example of the improvement is shown in Figure S.1, which displays monthly average end-to-end distribution times to forces deployed in Bosnia (left) and Kuwait (right) from January 1997 through August 2001.

As indicated by the chart on the left, not only did the monthly average end-to-end times drop sharply after the SD began, but the variability of the process was also significantly reduced. The chart on the right shows similar improvement in service to Kuwait, but adds an interesting twist. In this case, Army leaders had been so dissatisfied with the length and variability of performance that, in September 1999, they decided to contract with a commercial firm for air deliveries. This shift did result in improved service, as shown. However, leaders in SD and Central Command later decided that it would be better if Kuwait-bound cargo were once again carried by military air – but only if service and price were not harmed. Kuwait cargo reverted to military air carriers in April 2001, and the chart shows that, during the initial months after this switch,

“pushed” forward, or certain bulk commodities like fuel and food. Also, the focus to date has been on the distribution elements of the larger DoD supply chain. It does not take on the issues of supply availability or the incidence and length of backordered supplies. Also, it does not track the movement of personal cargo, such as luggage, household goods, or mail.

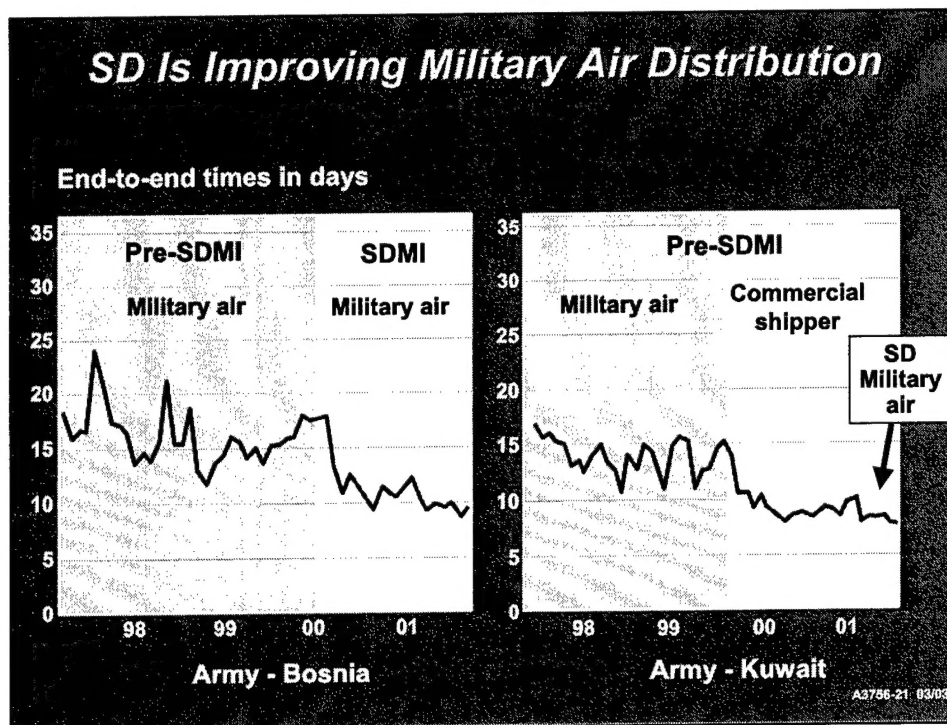


Figure S.1 – End-to-End Times for Military Air Distribution to Bosnia and Kuwait, January 1997–August 2001

military air performance matched (or slightly outperformed) that of the commercial carrier.

But then came September 11. The onset of Operation Enduring Freedom meant that virtually all military aircraft normally used in distribution were given to other missions, such as supporting deployment to and movement within the theater of operations. How well would the Defense distribution system perform its mission during wartime, in terms of both supporting deployed forces in the field and maintaining service to the worldwide customer base?

SD MET THE CHALLENGES OF OPERATION ENDURING FREEDOM

Through the strategic management of resources, the Defense distribution system was able to meet the challenges of OEF's first three months.⁵ To maintain service

⁵Combat operations began over Afghanistan on October 7, 2001, led by Air Force and Navy carrier-based bombers, and supported by Army special operations forces operating out of

to worldwide customers, commercial 747s were hired to take on routes previously flown by military aircraft, virtually all of which were removed from non-OEF service.⁶ Figure S.2 shows the impact of this move on support to the customer. The bars show the end-to-end times for the three major commands (European, Pacific, and Central) averaged together, while the darker and lighter lines in the background represent, respectively, the drop in the number of shipments carried by military air and the increase in shipments carried by commercial aircraft before and after the beginning of OEF. The consistent level of the bars demonstrates that, despite the disruptions of OEF, there was no noticeable impact on support to customers. This was the case even though the

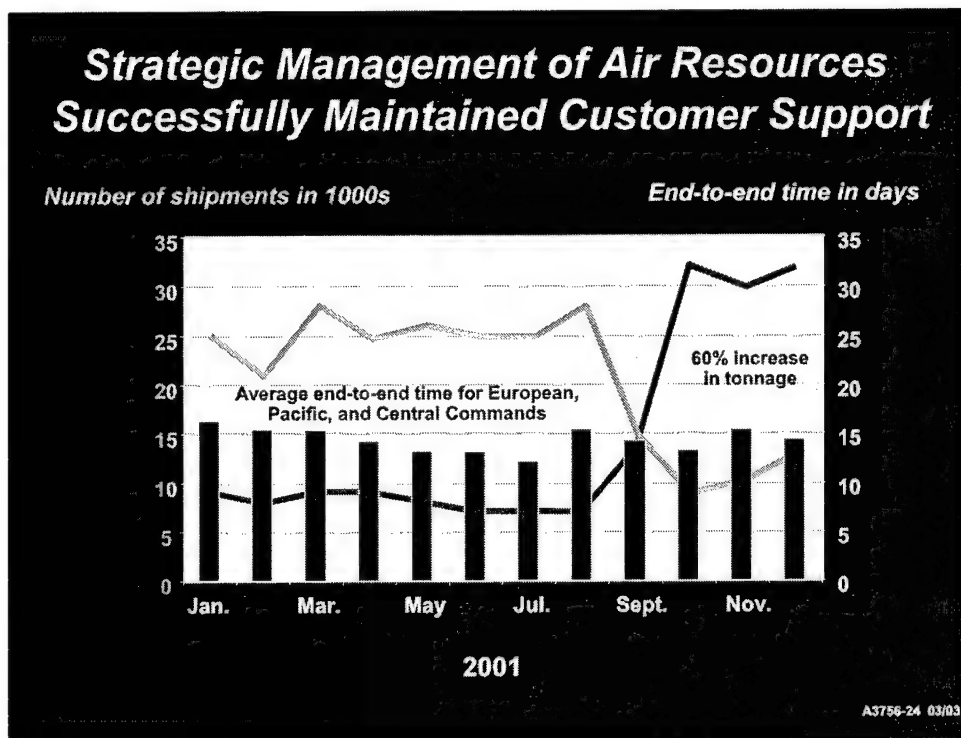


Figure S.2—Average End-to-End Times for European, Pacific, and Central Commands Before and After the Onset of OEF

Uzbekistan and elsewhere. The Taliban regime collapsed, and Kabul was liberated on November 16, 2001. This document analyzes support to forces deployed to the theater in the first three months of operation (October–December 2001). Operations continued past that period but entered a different phase, with the buildup of a more mature theater structure and more reliance on a theater distribution system. The follow-on phase of OEF operations will be analyzed in a future document that investigates strategic distribution to this more “mature phase” of OEF and the run-up to and actions during Operation Iraqi Freedom.

⁶Cargo was also diverted to surface modes when it made sense to do so.

volume of materiel carried through these channels increased by 60 percent following September 11.

To support forces engaged in OEF, TRANSCOM developed plans tailored to the specific needs of each type of force engaged in the fight. For the Air Force, the center of gravity in the first three months of OEF was Diego Garcia (in the Indian Ocean), where 18 B-1 and B-52 bombers were stationed. This small force was critical to the success of OEF; thus, the Air Force had a major need for fast and reliable movement of critical parts to keep all the bombers as operational as possible. Premium service from a commercial carrier like Worldwide Express was not an option, since there is no commercial service to Diego Garcia. Therefore, the Air Force negotiated with TRANSCOM and its Air Mobility Command about the level and speed of service needed. By synchronizing each step and bringing in commercial charters to fly routes generally flown by military aircraft between military ports, Air Mobility Command was able to achieve overall times to Diego Garcia that compared favorably to Worldwide Express performance and reduced end-to-end distribution times from 14 days to 9.

For the Navy, the main concern was to maintain at least the traditional level of support coming from the United States even as demand quadrupled with an increase in carrier battle groups in theater from one to four. Because the Navy operates within the area all the time, it has a well-developed base of operations in the Persian Gulf and was able, from the earliest moments of OEF, to apply large, sustained combat force over Afghanistan from attack aircraft launched from aircraft carriers in the Arabian Sea. The Navy's need for dependable service was answered through increased reliance on commercial charters flying within the "military air" system. And the large carrying capacity of the 747s allowed for a surge in capacity even while the level of responsiveness was maintained. Total cargo carried by commercial charters within the military air system went from 463 tons in June–August 2001 to over 2,000 tons in October–December, compared to increases from 333 to 727 tons for military aircraft.

Support for Army forces operating out of Karshi Khanabad in Uzbekistan posed a different kind of challenge. Karshi Khanabad is a bare-bones base with no history of U.S. deployments; its location was about as far as one can get from established U.S. support bases. The Army needed fast and dependable distribution to its deployed support structure, especially because its special operations forces supply activity was responsible for the needs of an unusually wide array of military units.

By relying upon the SD principles of stock positioning, schedules, and synchronization, TRANSCOM and DLA were able to provide the necessary level of support to the Uzbekistan deployment. Figure S.3 shows average end-to-end distribution time for Army forces deployed to Karshi Khanabad for the period of October–December 2001. Times, from request date to receipt, averaged about 16 days. In this case, there is no comparison of before and after, since the Army had never before deployed to Uzbekistan. But we can put these times into perspective by comparing the distribution time for Uzbekistan to times for other Army deployments that were using the Defense distribution system at roughly equivalent stages of deployment. The figure shows the times experienced by Army deployments to Kosovo, Bosnia, and Kuwait in the first months after setting up operations. Support to the Uzbekistan deployment compared favorably to the early deployment times of other Army operations—despite the much greater distance, the greater number of cargo “touches,” and channel congestion. Supplies sent to Uzbekistan required at least two transloadings, compared to one (such as to Kosovo and Bosnia) or none (to get to Kuwait). Unlike distribution during times of peace, shipments to Uzbekistan during OEF had to contend with the absence of any organic airlift capability. Finally, much

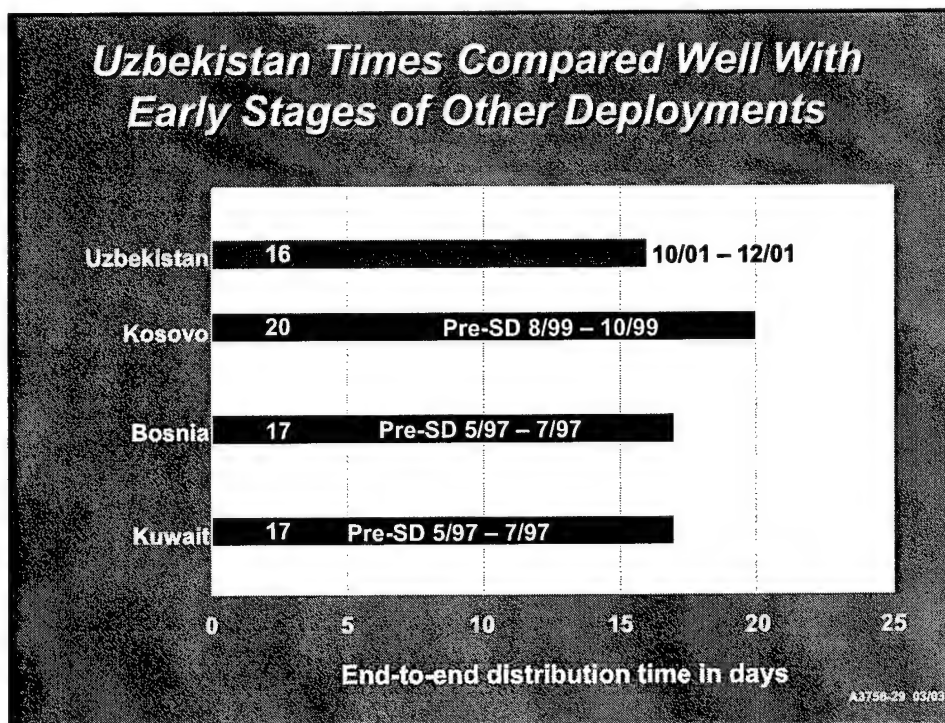


Figure S.3—End-to-End Times for Early Stages of Uzbekistan and Other Deployments

of the beginning-to-end time to Uzbekistan was accounted for by delays in the receiving units' ability to receive and process the incoming materiel, after it had left the strategic distribution system.

AFTER THE FALL OF THE TALIBAN

Operation Enduring Freedom was only the first challenge faced by the Defense distribution system after September 11, 2001. Since then, the system has been operating at virtually peak capacity at the same time that it is trying to implement the Strategic Distribution vision. In this new world, new areas and new challenges are taking on greater prominence:

- Integrating the strategic elements of the Defense distribution system with theater processes will become more prominent.
- Developing an integrated management to control the entire distribution process will become even more critical.
- Balancing the needs for deployment and sustainment across shared resources (ports, aircraft, etc.) will become more pressing.
- Improving the quality of in-transit visibility, such as through the use of radio frequency tags, will help deployed forces to better manage their needs.
- The continued reliance on commercial sources to carry cargo from Air Mobility Command ports will necessitate clearer policies on the division of labor between organic and commercial craft and how to manage the Civil Reserve Air Fleet (CRAF).
- The fact of U.S. forces increasingly dispersed across the globe suggests the need for expanding our view of stock positioning and balancing the usefulness of U.S.-based stocks at Strategic Distribution Platforms and theater-based stocks.

ACKNOWLEDGMENTS

The RAND team supporting SD has benefited greatly from the strong support of the SD community at all levels. General John Handy, Commander TRANSCOM, has been a powerful and vocal supporter of the initiative, as has VADM Keith Lippert, Commander of DLA. We deeply appreciate the efforts of LTG (ret.) Dan Brown, then DCINC TRANSCOM, to involve RAND in SD from the beginning and his continued support of our work, and we are grateful to LTG (ret.) Tom Glisson for his efforts on behalf of SD as the previous commander of DLA. Major General John Becker, Major General Bill Welser, Brigadier General Barbara Doornink, and Brigadier General (P) James Pillsbury have provided strong, effective management of the SD effort on a day-to-day basis and have helped us immeasurably in our efforts to provide support. We are especially grateful to Mr. Frank Weber, the Executive Agent for SD, for all that he has done in both encouraging RAND contributions to SD and squeezing the best performance he could out of both RAND as his analytical support and the SD teams under his direction. We have benefited from the support of two superb action officers as heads of the SD Core Team (now Program Office): Col Gary Melchor and LtCol(P) Tye Beasley. They, and the excellent Core Team operating under their direction, have made SD a real, living entity on a day-to-day basis and have helped us immensely in becoming an integral part of this dynamic enterprise.

MG Kenneth Privratsky (ret.), Commanding General, Military Traffic Management Command, played a forceful role in shaping the SD vision and mission and inspiring the efforts of all those who came in contact with him. BG(P) James Pillsbury, Commanding General of the Defense Distribution Center, his deputy, Ms. Phyllis Campbell, and her key staff members Mr. Charlie Nye and Mr. Scott Rosbaugh have each played decisive roles in SD's continuing successes. To all of these individuals we owe a debt of gratitude for helping RAND play its role in the SD mission.

We owe specific thanks to a group of committed, energetic, and talented individuals for making possible this study of air distribution in Operation Enduring Freedom. Our greatest thanks go to Col Don Siegel, then head of Channel Operations, Tanker Airlift Control Center (TACC/XOG) of Air Mobility Command, and his unflappable, omniscient deputy, Ms. Sharon Boynton. We are grateful for the support of all his able team, especially Captain Robert

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Colonel Rich Modell and his people at HQ Air Combat Command, and Mr. Richard Reed and Mr. Howard English and their staff at Air Force Materiel Command (especially Chris Arzberger) made our analysis of support to Air Force units in OEF possible. We are grateful to Captain Bob Mundell and his excellent team (especially Commander Michael Everingham) at NAVTRANS for helping us understand Navy support issues.

At RAND, Ken Girardini and John Folkeson have helped contribute strong project leadership to our SD efforts, as did Mark Wang earlier in the project; much of the goodness in this document comes from their efforts. We thank them and their task teams. We owe special thanks to Arthur Bullock for his superb database management efforts. We also wish to acknowledge Sandy Petitjean for the remarkable job she did in creating effective and striking graphics for this documented briefing and to thank Pam Thompson for her superb map-building and manuscript management.

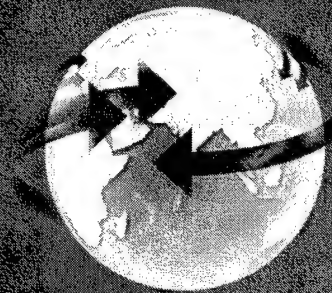
GLOSSARY

AMC	Air Mobility Command
BSM	Business Systems Modernization
CCP	Containerization/consolidation point
CINC	Commander-in-Chief
CRAF	Civil Reserve Air Fleet
DDC	Defense Distribution Center
DLA	Defense Logistics Agency
DoD	Department of Defense
DDS	Distribution System Support
DTS	Defense Transportation System
FFRDC	Federally funded research and development center
GATES	Global Air Transportation Execution Systems
GSA	General Services Administration
LMARS	Logistics Measurement and Reporting System
MILSTRIP	Military Standard Requisition and Issues Procedures
MSDDC	Military Surface Deployment and Distribution Command
OEF	Operation Enduring Freedom
OSD	Office of the Secretary of Defense
SD	Strategic Distribution
SDMI	Strategic Distribution Management Initiative
SDP	Strategic distribution platform

TDMC	Theater Distribution Management Center
TRANSCOM	U.S. Transportation Command
VM	Velocity Management
WWX	Worldwide Express

As Far As It Can Get

The Defense Distribution System and Its Role in Operation Enduring Freedom



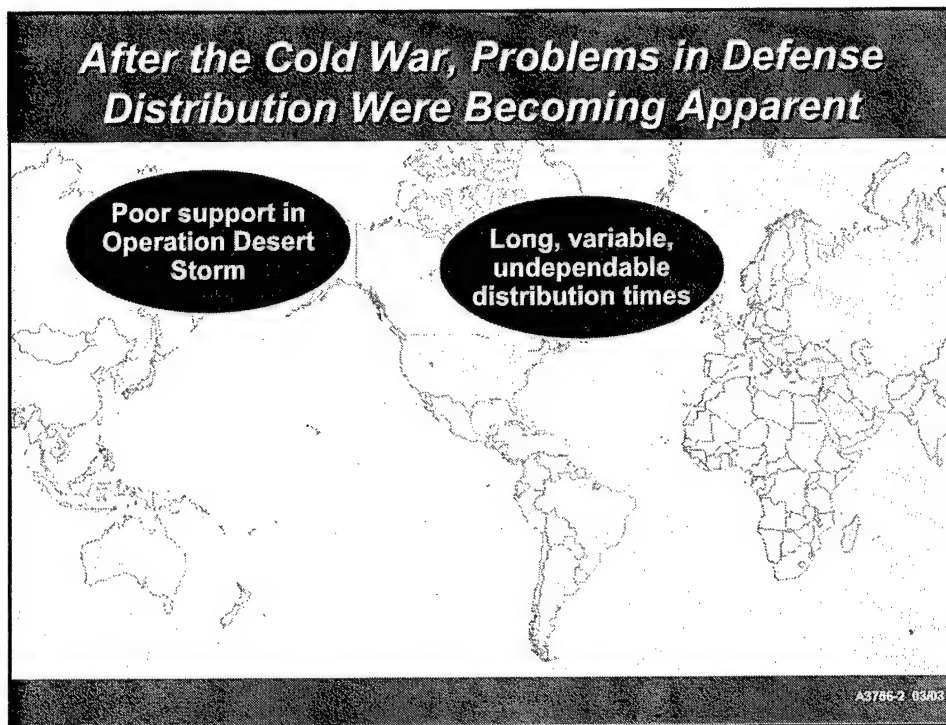
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In early 2000, leaders of the U.S. Transportation Command (TRANSCOM) and the Defense Logistics Agency (DLA) agreed to embark jointly on the "Strategic Distribution" program (SD)⁷ as a means to streamline and improve significant elements of the Defense distribution system, and thereby deliver more reliable and cost-effective service to DoD forces and organizations in the United States and around the globe. For over a year and a half, SD teams made considerable progress in enhancing the underlying structure of the Defense distribution system and improving service through a series of rolling implementations.

In 2001, Operation Enduring Freedom (OEF) posed a demanding challenge to the Defense distribution system and tested the principles and strategies that were being implemented through SD. SD's main goal of providing fast, reliable service to its worldwide customers had to be met in a new environment in which vital resources, usually devoted to moving cargo to worldwide military units, were pulled away for months at a time to support other war-related missions, while forces were deployed to new bases at the far ends of the globe.

⁷Prior to May 2002, it was known as the Strategic Distribution Management Initiative (SDMI). The name change was to indicate that strategic distribution improvement, as pursued by SDMI, had moved from being an "initiative" to becoming the normal way of doing business.

This documented briefing seeks to explain the multistranded story of SD, explaining why a significant change was needed in Defense distribution, how SD sought to transform the system, and how well that system met the challenge of OEF. It is based on a briefing originally prepared for the RAND Board of Trustees and presented in RAND's Washington, D.C. office on April 11, 2002.



The Defense distribution system is the part of DoD that manages and executes the storage and movement of supplies to military customers at home and around the world.⁸ It is not a system that has performed all that well in recent years. After the end of the Cold War and throughout the 1990s, the U.S. military became more expeditionary, a change that exposed problems in the Defense distribution system's ability to support worldwide forces.

Performance for the Persian Gulf in 1990 during Operation Desert Storm was problematic. Although combat performance in this operation has been justifiably esteemed, there were significant problems in logistics support during the war and the period leading up to it, with the problems caused by poor distribution being particularly acute. Distribution was unreliable in large part due to inefficient processes, clogged ports, and a myriad of other problems. The result

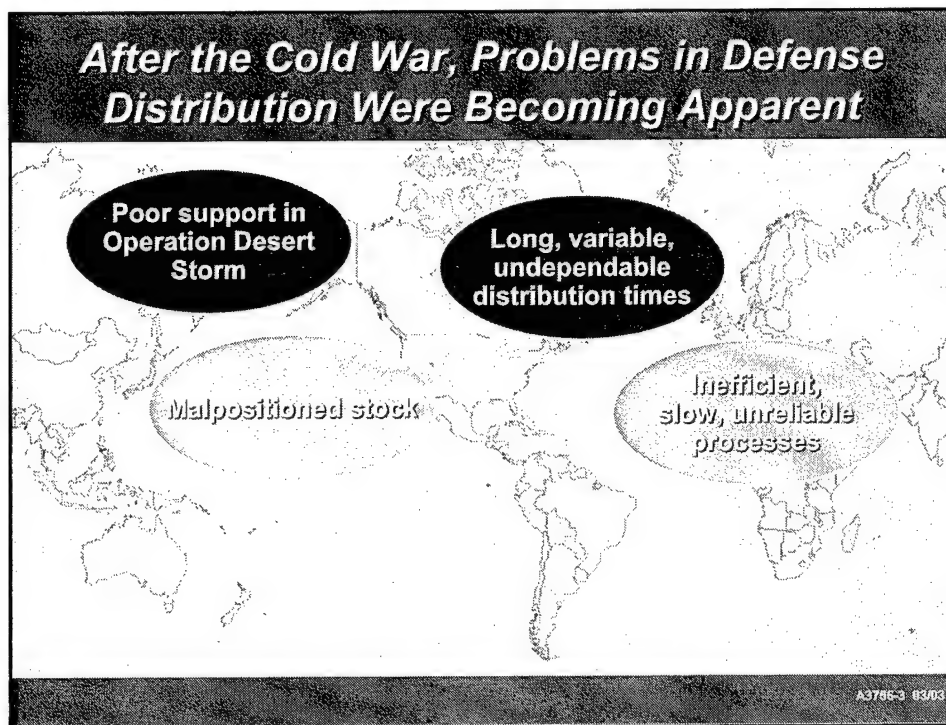
⁸The Defense distribution system is distinct from the more familiar Defense Transportation System (DTS), defined as "That portion of the worldwide transportation infrastructure which supports Department of Defense transportation needs in peace and war." (DoD Regulation 4500.9—Defense Transportation Regulation, quoted in US TRANSCOM Handbook 24-2, "Understanding the Defense Transportation system (1 April 1997)," p. 1. The DTS is a vital part of the Defense distribution system, but the latter encompasses more of the vital activities—storage, mode selection and balancing, end-to-end service—that determine overall support to the customer.

was that materiel often took more than 35 days simply to get out of the United States.⁹ Such problems continued throughout the 1990s in a distribution system characterized more often than not by unreliability and long and unpredictable service.

This is not to say that there weren't successes in this period. The services pursued several logistics initiatives that led to better performance, such as the Army's Velocity Management initiative, the Air Force's Lean Logistics, and the Marine Corps' Precision Logistics. In addition, DLA took control of all of DoD's distribution centers and made progress in improving their management, costs, and performance. Sometimes, improvements were dramatic; for example, average times for Army customers in the United States fell from over 20 days to under 10.¹⁰ Yet significant problems remained in the global distribution system.

⁹Nancy Y. Moore et al., *Materiel Distribution: Improving Support to Army Operations in Peace and War*, Santa Monica, CA: RAND, MR-642-A, 1997, p. 7.

¹⁰See John Dumond et al., *Velocity Management: The Business Paradigm That Has Transformed U.S. Army Logistics*, Santa Monica, CA: RAND, MR-1108-A, 2001.

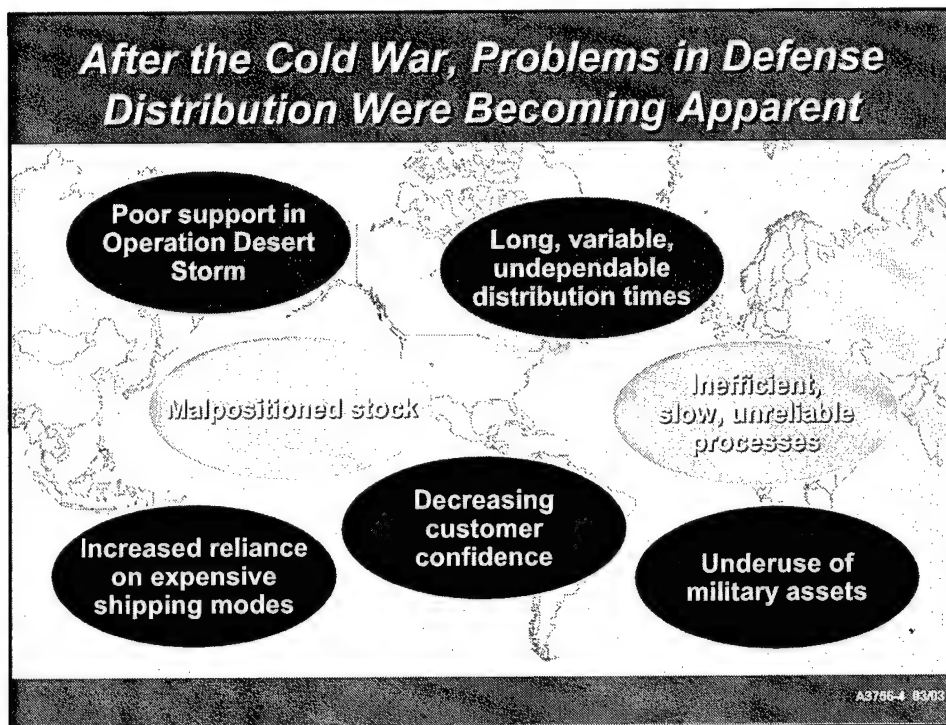


To understand how the distribution system could be designed to support a power projection military, it is necessary to focus on the nuts and bolts of distribution—including where stock is placed and the methods by which it is moved from storage to customer. The structure of a distribution system defines how well it can work, as the best practitioners of distribution, such as Wal-Mart, have found as they've honed their systems.

Many of the problems in the Defense distribution system are related to malpositioned stock. With inventory scattered at dozens of locations in the United States and around the world, DoD has effectively made each supply point a worldwide distributor, thus removing the benefits of economies of scale. This stock fragmentation is itself a legacy of the earlier period, and it reflects both a service and a functional orientation relevant at a time when all the services, as well as DLA, owned and operated wholesale supply depots, and transportation was considered a separate function. Although DLA took control of distribution centers in the early 1990s, the methods used to stock these depots are still controlled by the services (and the inventory control points of DLA) and thus perpetuate the same inefficiencies.

The best business distribution practices emphasize streamlined flows and a minimization of stops, queues, and touches. However, the Distribution System

Support (DDS) often did not follow these principles. Prior to and throughout the 1990s, the distribution methods used to move stock from supply points to customers undermined effective customer support due to their inefficiency and ineffectiveness. Defense distribution modes performed poorly because they were not structured to deliver the best service. For example, a DoD seavan—a 40-foot ocean-going container stuffed with cargo—may sit at a port for several weeks, waiting for the ship it was booked on weeks before, while in the meantime, other available ships depart from the port. Or, to cite another example, a pallet of consolidated materiel may sit at a transit hub like Ramstein, Germany, for days waiting for theater airlift, even though a truck could deliver it to the European military customer in a day.

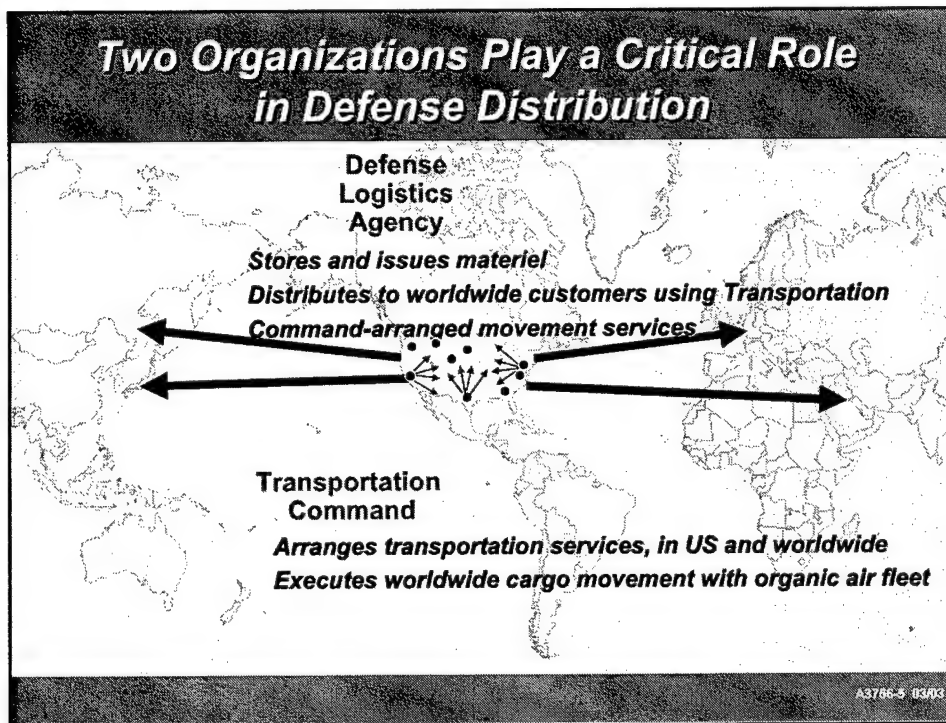


The end result of the DoD's ineffective distribution modes was poor, unreliable service, as we will demonstrate with a few examples later in this document. So it is no surprise that customers lost confidence in many parts of the Defense distribution system and looked for alternatives.

To maintain readiness and support operations, customers often insisted on the most reliable service, such as FedEx and Worldwide Express (WWX), both of which deliver excellent service albeit at high prices. Customers were less inclined to rely on modes such as military air cargo movement offered by Air Mobility Command, a component of TRANSCOM. Although that service tended to be cheaper than premium services like WWX, its poor performance and unpredictable delivery times often made it second choice among DoD customers. In some cases, such as with Army forces in Kuwait, military air service was stopped entirely, and the customer signed up with commercial distribution providers. That loss of business, combined with a secular decline in military cargo during the 1990s, led to underuse of military air cargo capacity and caused reverberations for the wartime readiness of air crews and ground elements. Air Mobility Command pays for its wartime training in large part by carrying

military cargo in peacetime. As funds declined, military flying declined and, with that decline, the threat to crew readiness increased.¹¹

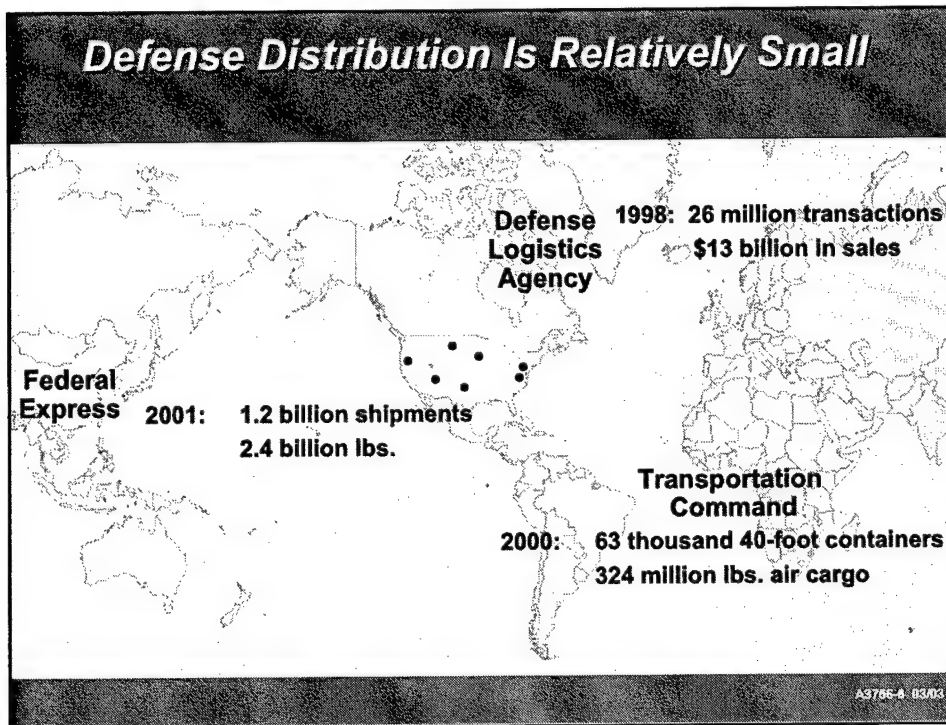
¹¹Brian G. Chow, *Meeting Demand and Maintaining Readiness*, Santa Monica, CA: RAND, MR-1506-AF, 2003, especially chapters 2 and 6.



It was these disturbing trends that led leaders of major parts of the Defense distribution system to join forces to seek improvements. Those two major players, already mentioned in passing, are the Defense Logistics Agency (DLA) and U.S. Transportation Command (TRANSCOM). DLA plays several roles in DoD's supply chain. It manages large parts of DoD's wholesale inventory through several inventory control points, mostly handling consumable items (e.g., piece parts, fuel, food). It also controls all wholesale supply depots, or distribution centers, where it stocks materiel, processes it for shipment, and arranges shipping to customers. It contracts with commercial distributors, as well as with TRANSCOM as a provider of shipping services, to move cargo to its ultimate destination.

TRANSCOM provides military management of distribution to worldwide locations, with a focus on customers outside the United States. Its Air Mobility Command component owns and operates fleets of organic aircraft (e.g., C-17s, C-5s, KC-10s) that move cargo, vehicles, and people or provide in-flight refueling. Its Military Traffic Management Command is responsible for seaport operations, arranges for commercial movement of ocean-going containers, or seavans, around the world, and it also manages DoD's contract base with U.S. trucking companies and other modes of shipment within the United States. The last component command, Military Sealift Command, maintains a fleet of cargo

ships ready to be used in wartime for deployment of weapons and supplies. On the air side, TRANSCOM, via Air Mobility Command, also contracts with commercial transporters to provide planes (such as 747s) to supplement its organic fleet when need and demand arise. Air Mobility Command also arranges for commercial contracts and tenders for air transportation, including the widely used "Worldwide Express" (WWX) premium air shipment program.

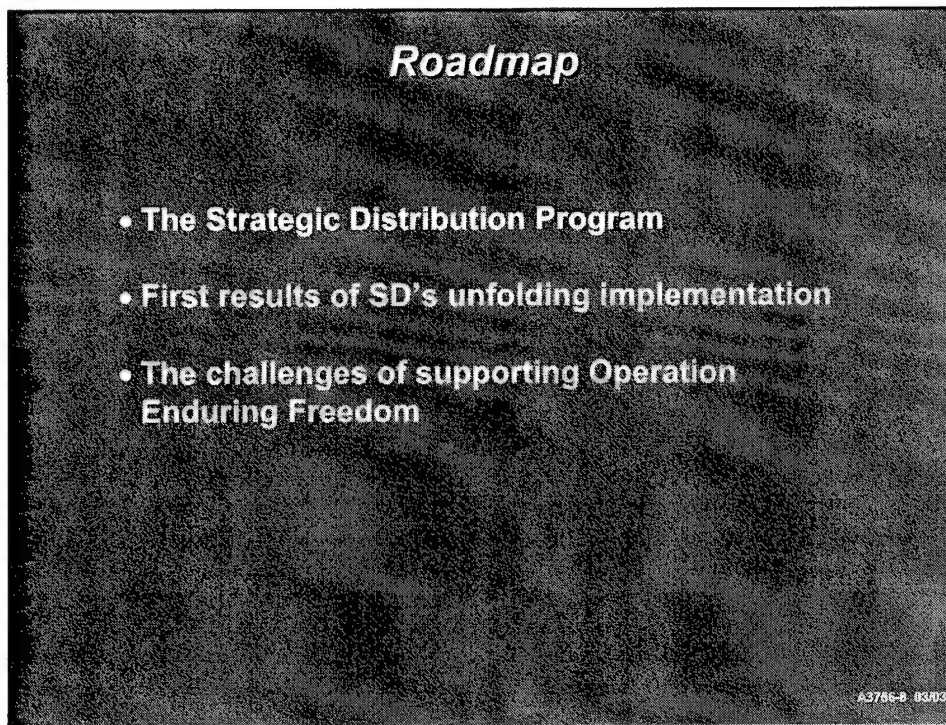


Defense distribution is not a large business, especially when compared to an international giant like FedEx. The latter moves shipments that number in the billions, compared to the millions of shipments moved by TRANSCOM. The challenge of the Defense distribution system is not one of volume so much as unpredictability and volatility. Whereas FedEx may see relatively narrow surges and declines from year to year, the Defense distribution system can experience severe up-and-down movements from one year to the next.¹²

The challenge the Defense distribution system faces, then, is in many ways unlike that of commercial firms. For the latter, steady growth and profitability are the goals; increasing productivity and efficiency are means; and the actions of competitors and uncertainty in markets and general economic trends are the major constraints. For the Defense distribution system, efficiency and productivity are also critical, but growth and profitability are not. What is especially different for the defense system is the much larger uncertainty in demands (as Operation Enduring Freedom will show later in this document) and the need to meet all customer demands, not just those that maximize

¹²FedEx 2001 Annual Report (<http://www.fedex.com>);
Transportation Command 2000 Annual Report (<http://www.transcom.mil>);
DLA Dimensions 1999 Almanac Edition (<http://www.dla.mil>).

profitability. Thus, the Defense distribution system, like the U.S. Postal Service, must deliver to places that profit-maximizing commercial firms might never visit, and it must procure and hold low-demand items that would never be cost-justified in the commercial sector.



The outline for the remainder of this document is shown above. We will first discuss the why and how of the SD effort. We will then provide some examples of early implementations and, finally, discuss the ability of the Defense distribution system to support forces engaged in Operation Enduring Freedom while maintaining service levels to nonengaged forces worldwide.

The Strategic Distribution Program (SD) Started in 2000 with RAND Assistance

- **Transportation Command and Defense Logistics Agency leadership recognized shortfalls and created a partnership to form SD**
- **Velocity Management alumni played critical role**
- **RAND was asked to support efforts by providing:**
 - case for change
 - strategic vision
 - metrics, performance reporting, and analysis

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It was to tackle the problems described above that senior leaders of DLA and TRANSCOM created the Strategic Distribution Management Initiative.

SD was started in early 2000 by the head of DLA and the Deputy Commander-in-Chief of TRANSCOM. Both were veterans of the Army's Velocity Management (VM) initiative, a similar effort to improve ineffective Army logistics processes. One critical element of the VM effort was the building of a coalition across organizations both inside and outside the Army. For example, through VM, the Army and DLA built a close working relationship that paid dividends in better service at lower cost.¹³

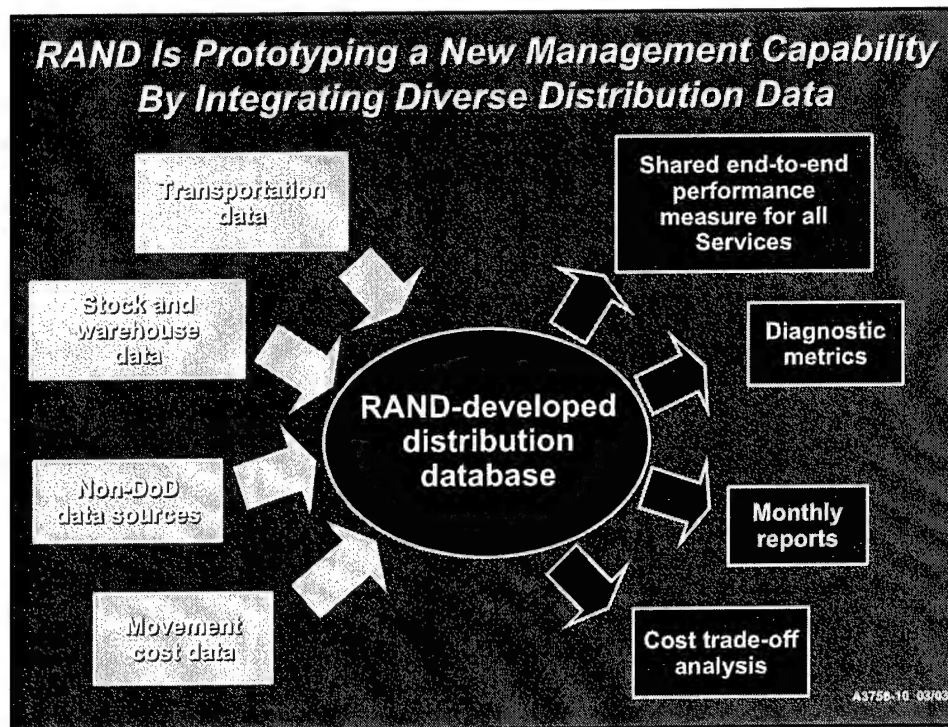
Like VM, SD was founded on the principle of a partnership among stakeholders and process owners in the Defense distribution system. DLA and TRANSCOM can be described with some accuracy as the major owners of the wholesale part of the DoD supply chain: they play major roles in acquiring, storing, and moving materiel needed by DoD customers in the United States and around the world. The two play independent roles yet also depend on each other: DLA on TRANSCOM for movement of critical materiel to their customers by sea and air, and TRANSCOM on DLA as a major provider of the business that helps fund

¹³See Dumond et al., op cit.

and justify the training missions flown by TRANSCOM around the world in preparing for its wartime mission.

The RAND Arroyo Center, a federally funded research and development center (FFRDC), also played a role in VM, and it worked with both of these leaders during their VM involvement. Partly from that experience, RAND was brought on to assist the SD effort. With SD, RAND provides many of the same services it had been providing, and continues to provide, with the Army's VM initiative; indeed, many of the researchers at RAND who supported VM joined the RAND SD project team.

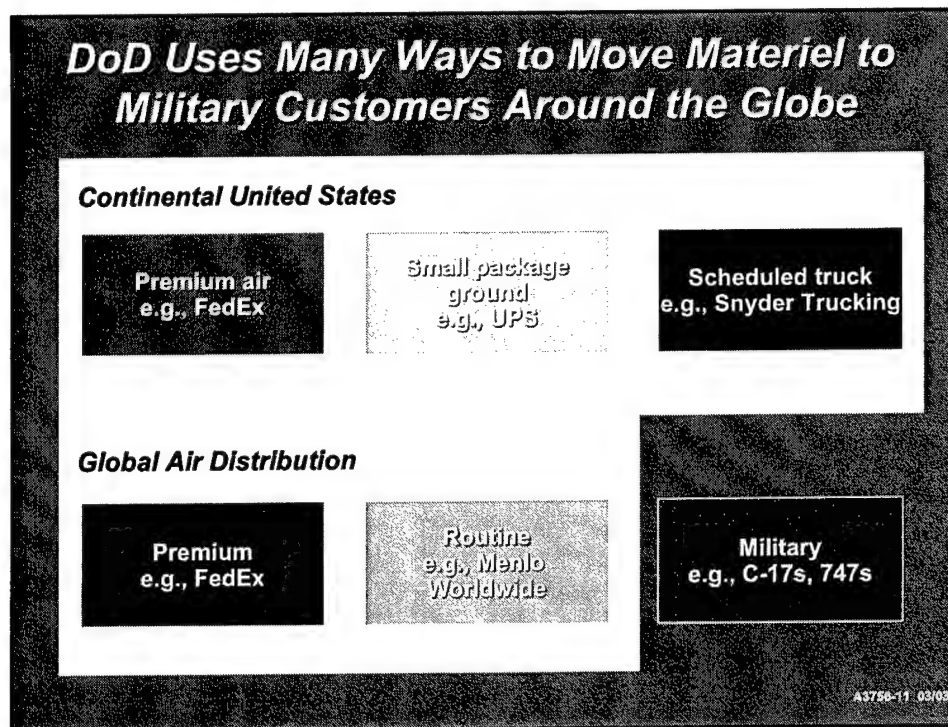
There are several ways in which RAND is assisting this effort, including laying out a persuasive case for change and delineating an "end state" of how defense distribution should operate. As in VM, RAND is playing a central role in assembling and integrating data to provide a comprehensive view of processes, and using that data to build metrics, reports, and analytical products supporting improvement efforts.



One of RAND's contributions to the SD effort has been to help develop a DoD-wide "distribution enterprise" database, aimed at giving stakeholders in the Defense distribution system far better visibility of distribution activities than has previously been possible. Although end-to-end metrics have long been available, principally through the Logistics Measurement and Reporting System (LMARS) reports created by the Defense Automated Addressing System Center, the level of detail in those reports (or the underlying database feeding them) was insufficient to guide process improvement actions. An integrated distribution database is able to do many things:

- create a common language of distribution among all system participants, including providers and customers;
- show end-to-end times as well as break times out in the greatest number of segments possible, with no "air gap" between segments (i.e., all distribution times must be under the control of a process manager);
- be able to clearly identify means and modes, such as where materiel came from, what distribution decisions were made, what mode of distribution was used, and so forth;
- lay out as many of the costs of distribution as possible.

By tying disparate data sources together – some not from DoD, such as the General Services Administration (GSA) database – the SD “distribution enterprise” database has for the first time given DoD a way of looking at distribution activities comprehensively, including both performance (e.g., time) and cost. The tool provides a view into distribution across all DoD customers and so creates a shared language among the services. By starting at the individual shipment level and building up, it allows the analyst to diagnose system problems and help identify the best areas for improvement. The database is being used to produce frequent reports on distribution performance for senior leaders in the Defense distribution system, the services, and the regional commands, which have included weekly reporting during the first months of OEF.



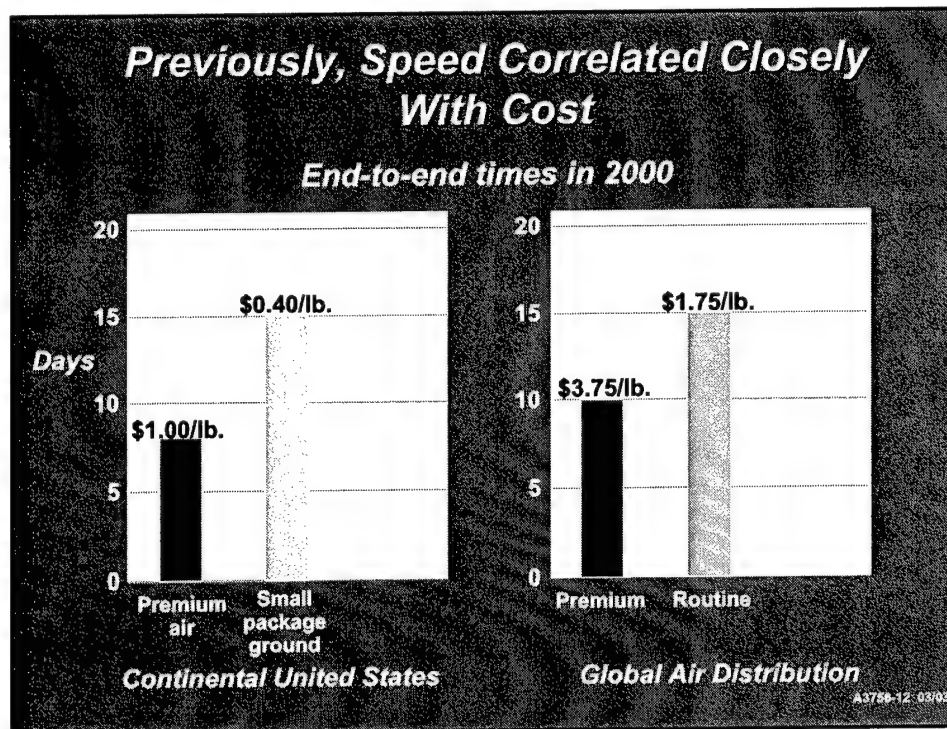
To give an example of how this database can be used, the next few charts focus on some of the ways materiel is moved within the United States and globally by air.

Much DoD materiel is moved commercially. Just as a private citizen might "contract" with FedEx to send a package from Point A to Point B, DoD gives packages to commercial carriers who move them through their set channels all the way to the customer.

DoD also executes distribution itself, especially for global air movement. TRANSCOM, through its Air Mobility Command component, uses its military aircraft to move cargo as they perform training missions worldwide to prepare for their wartime mission; as mentioned earlier, carrying that cargo is an important means by which TRANSCOM gets the revenues to pay for that training. Because military aircraft are not always available, TRANSCOM also has the ability to charter commercial cargo planes to fly the same routes as the military aircraft. These arrangements are set up so that TRANSCOM directs the

movement and scheduling of those commercial charters, which it obviously would never do with a carrier like FedEx.¹⁴

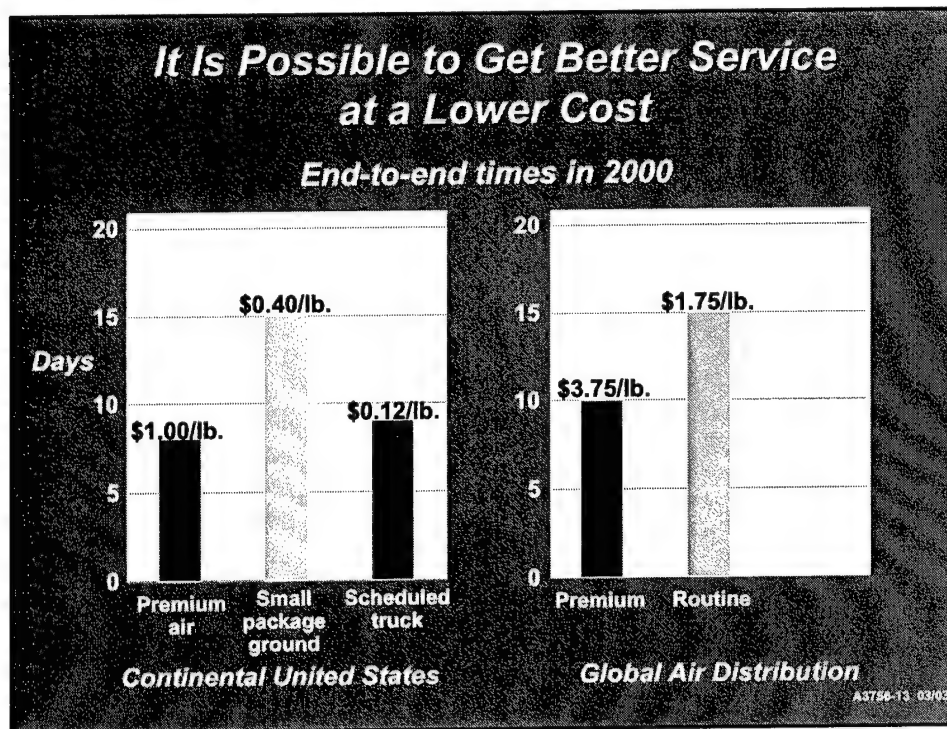
¹⁴The six categories on this chart are meant to be representative of distribution modes, and not an exhaustive list. In fact, DLA lists 22 different modes of shipping, which include those shown here. Also, much cargo for global destinations travels by surface (such as in 40-foot containers carried by container ships). This global surface distribution is a major focus of SD efforts, and it has been documented in unpublished RAND research by John Folkeson, John Hollywood, Patricia Boren, and Shelley Wiseman, "Improving DoD's Surface Supply Chain through the Strategic Distribution Management Initiative." In the current document, we do not discuss SD efforts to improve global surface distribution.



Using the SD-integrated distribution database, one can see how the system works in general. The chart above shows end-to-end distribution time for all customers, covering elapsed time from customer need to customer receipt.¹⁵ Here one sees performance by mode along with the cost of movement. The chart shows gross overall performance for the entire “baseline year” for SD, calendar year 2000; all four services and all locations are aggregated into a single result. The underlying database allows any level of breakout: by service, by location, indeed, by individual shipment.

¹⁵End-to-end time for SD metrics is called “CWT minus” (CWT-). This metric captures total time from identification of customer need (captured in the requisition document) to acknowledgment of receipt by customer, signified by posting a D6S/DRA receipt transaction. The database contains all such transactions from January 2000, and it is updated constantly. It is, however, limited to MILSTRIP (Military Standard Requisition and Issue Procedures) transactions that route through the Defense Automated Addressing System (DAAS), located in Dayton, OH. That is, its main focus is on customer demands on the wholesale system; customer requests satisfied by local (“retail”) supply sources are typically not shown. Also not included are supplies obtained through alternative means, such as by credit card purchase or managed as part of the “Direct Vendor Delivery” (DVD) program, where storage and movement are handled completely by vendors. In addition, items that are moved outside the MILSTRIP system – such as luggage, household goods, or personally owned vehicles – are not part of the database. Finally, because SD focuses on the distribution part of DoD’s global supply chain, backorder time is not included in measuring CWT-.

The “end-to-end times” shown in the chart (“customer wait time minus” in the SD terminology, as explained in footnote 15) represent inclusive overall times needed to get items to customers. That is, while the *transportation* time for premium services like FedEx to U.S. destinations is typically one day, the *total end-to-end time* is considerably greater than that, as it includes all parts of the distribution process: from submitting the requisition, to processing and transporting the shipment, to processing the customer receipt. But even with the nontransportation processes included, the chart makes clear that premium service yields better overall time. Indeed, the standard paradigm is that higher cost yields better service: next-day FedEx costs more than parcel post.

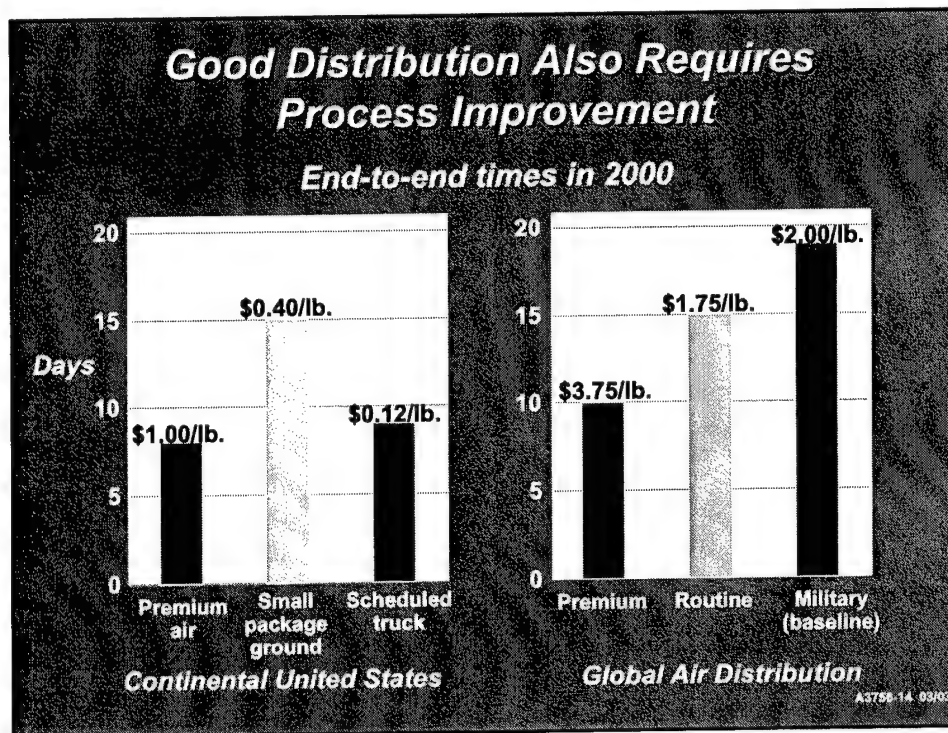


One of the guiding principles of SD, as for VM, is to find “win-win” outcomes where responsiveness is improved while costs are reduced. Under VM, the Army/DLA partnership found that one means to achieve such an outcome, under certain conditions, is to put more reliance on scheduled truck service to major customers from major distribution centers. Many large customers, such as Fort Bragg or Camp Lejeune on the East Coast, or the National Training Center or Camp Pendleton on the West Coast, are within a day’s drive from the two major DLA distribution centers at Susquehanna, PA, and San Joaquin, CA, respectively. If enough of the customer’s required materiel is located at that distribution center, it may be cost-effective to simply put the materiel on a truck leaving daily for the customer, which makes an overnight drive to deliver the cargo the next morning. And indeed, given the costs of sending things from Susquehanna to Fort Bragg by FedEx, the truck doesn’t have to be all that full to provide cost savings.

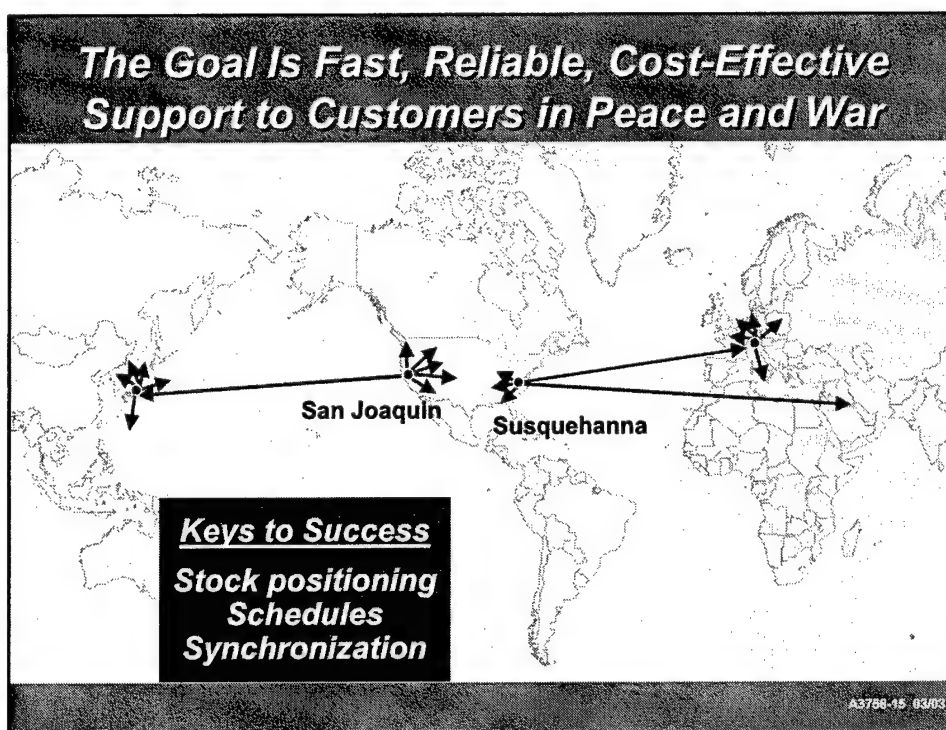
The chart above shows how the use of scheduled trucks for U.S.-based DoD customers has broken the price/responsiveness paradigm. Because of the relative cheapness of trucks and the volumes they are able to carry, the per-pound cost of using them is a fraction of that for premium air, and indeed a fraction of less-responsive shipping modes like small package ground. But the

level of responsiveness is virtually the same as premium air¹⁶ and significantly better than the still more expensive small package ground mode.

¹⁶Because travel time is the same for premium air and scheduled truck for the most part (i.e., typically next day), end-to-end times should be roughly the same. The chart shows they are close but not quite equal: scheduled truck is somewhat slower. There are several reasons why: not all customers can justify a truck every day, some customers are a two-day drive, etc. There is also evidence that not all the materiel gets on the next available truck, suggesting room for improvement in distribution center processes.



Military air distribution to global customers breaks the price/responsiveness paradigm the other way as well: it often delivers poorer performance at higher prices than commercial counterparts. There are often many good reasons for the higher price and lower responsiveness, such as the requirement to fly to out-of-the-way places that commercials tend not to frequent, and the obligation to carry the oversized, hazardous materiel that commercial firms cannot carry (at least not at reasonable cost). But beside those causes, there are other reasons for poor performance: lack of customer focus, lack of integration across the entire chain of distribution, and poor execution at vital nodes, such as port processes. The goal of SD is to attack the causes of bad customer support that can be changed and, as with the scheduled truck example, seek "win-win" solutions.



To take advantage of good ideas — like the scheduled truck paradigm — and to attack system problems — as experienced with military air — SD is pursuing implementation of a strategic vision of Defense distribution, which is simply illustrated on this chart. The keys to this vision are the “3 S’s” of stock positioning, scheduled movement, and synchronization of each step.

The “win-win” solution of scheduled trucks comes from economies of scale, and that begins with stock positioning — putting inventory in the right place. Rather than scattering military cargo over dozens of locations, SD seeks to maximize the amount of cargo into two locations in the United States (and several more outside the United States to be close to other global customers). When more materiel that a customer needs is located at one place, more materiel can be put on a truck, leading to lower unit costs and more truck runs per week.

Once launched from what SD is calling its “Strategic Distribution Platforms” (SDPs), movements rely on schedules as much as possible: e.g., trucks must leave at a certain time each day and arrive at their destination at a set time. Further, these steps must be synchronized with each other to minimize queuing and hold times — all the non-value-adding elements that make performance slow and unreliable. Synchronization will be discussed in more detail later, when we look at improved performance to units in Bosnia and Kuwait.

The overall goal of the vision, then, is to reduce the length and variability of distribution to all DoD customers at home and around the globe, and reduce costs in order to save money for customers, DoD, and taxpayers. And finally, the system must be robust and deliver the same level of performance in peace and war.

Roadmap

- The Strategic Distribution Management Program
- First results of SD's unfolding implementation
- The challenges of supporting Operation Enduring Freedom

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Given the size and spread of the Defense distribution system, and also given that many of the factors underlying poor performance cannot be changed in the near term, SD has always been seen as a multiyear effort, with benefits gained year by year. Many of its early initiatives were targeted at specific customers, although lessons learned could be applied more broadly around the world. The next section describes the fruits of some of the early efforts of SD.

SD Efforts Are Yielding Results

- **More stock is being repositioned to East and West distribution centers in the United States**
- **New customers and routes are being established for scheduled trucks**

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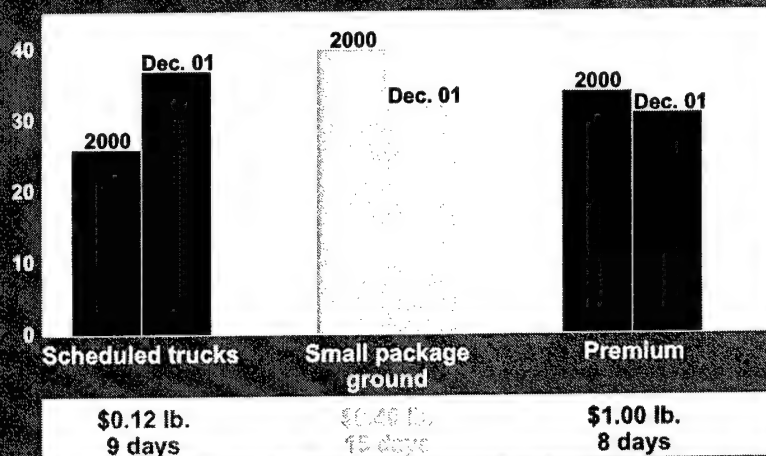
SD has made significant strides in consolidating more inventory at its East and West U.S. locations as well as building up stock points closer to the customers in Europe. The SD goal for stock positioning is to have at least 85 percent of a customer's shipments come from his or her SDP; this percentage is tracked through a metric known as "facing fill," that is, the fill from the SDP closest to, or facing, the military unit. In the 2000 baseline year, the facing fill was under 56 percent for all DoD requisitions. For all of 2001, the number increased to 61 percent, and by March 2002 it had climbed to almost 65 percent. Improvements in facing fill were accomplished mainly by moving malpositioned stock between DLA distribution centers. Although this method has led to the improvements described, it has its limitations, not the least of which is that it would have to be repeated indefinitely in the future. Thus, the key to future facing fill improvements, and the key to achieving the 85 percent goal, is to improve acquisition processes so that when materiel is purchased it is put in the right distribution center in the first place.¹⁷

¹⁷Because "first destination" inventory movements (from the vendor to the DLA distribution center) are hardwired into DLA systems, this "redistribution" method has been followed until recently. A new DLA system, the Business System Modernization (BSM), will permit much more effective first-destination allocation from the vendor. When fully implemented, it should create the basis for much higher facing fills and much less reliance on distribution center-to-distribution center redistributions.

Service has also improved because of the combination of better stock positioning and the increased use of scheduled trucks. Improvements in stock positioning benefit the use of scheduled trucks in two ways. First, users of scheduled trucks benefit from reduced times and lower cost as more and more of their materiel arrives in a single delivery from a scheduled truck rather than by many deliveries from multiple sources. Second, the increased volume available from one location can make it cost-effective to increase the frequency of delivery to customers and to add new customers, as necessary. The end result is better service to more and more customers at lower cost.¹⁸

¹⁸More detail on SD stock positioning and scheduled truck efforts is available in unpublished RAND research by Kenneth Girardini et al., "Improving Stock Management in the DoD Distribution System: Metrics and Progress."

Increased Use of Scheduled Trucks Is Improving Service and Reducing Costs



Percentage of shipments to top 125 U.S. military locations

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Comparing three of the main modes of shipping to continental U.S. customers, we see a significant increase in the amount moved by scheduled truck by December 2001 compared to the baseline year 2000 (and that percentage has continued to grow since then).¹⁹ Both the slower small package ground and faster premium service roles have diminished, more for the former than the latter. These changes are resulting in overall better service to customers and falling distribution costs to DoD as a whole. DLA estimates that better positioning, in the continental U.S. and abroad, and more use of scheduled truck service will save at least \$120 million over the next five years (2003–2007), with potentially more as additional routes are identified and implemented and better stock positioning is employed.²⁰

¹⁹The chart shows results for the top 125 DoD customers in the continental United States. These account for over 70 percent of all shipments to U.S. customers. SD efforts to build scheduled truck service presupposes sufficient volume to justify a truck, but many of the smaller DoD customers (e.g., ROTC units) are too small, or too far away from a larger customer region, to justify a truck of their own or a stop on a truck route.

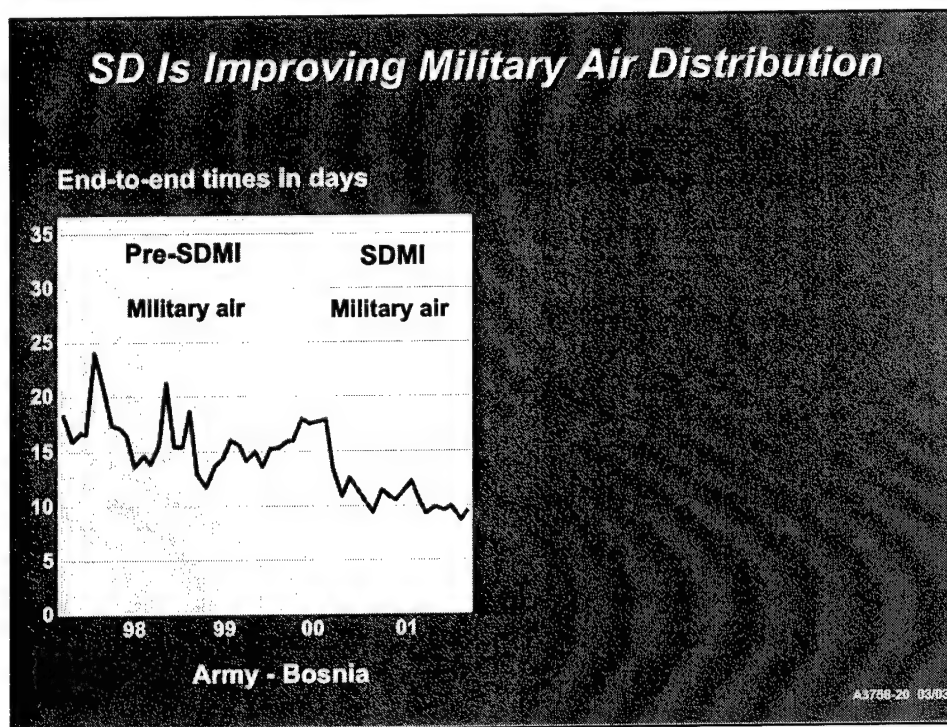
²⁰Stockage Committee update to the SD Council, May 12, 2003.

SD Efforts Are Yielding Results

- More stock is being repositioned to East and West distribution centers in the United States
- New customers and routes are being established for scheduled trucks
- Improved military air distribution is matching commercial service in cost and performance

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SD teams have made major efforts to improve the flow of cargo via military air distribution by better synchronizing movements from the United States, into the theater, and onward to the customer. Efforts have been rolled out on a customer-by-customer basis, beginning in Europe, moving on to the Middle East, and starting in the Pacific in April 2002.



This chart shows the impact of SD on military air distribution to Army forces deployed to Bosnia. The figure depicts average monthly end-to-end time from 1997 to August 2001. Not only did the monthly average drop sharply after the commencement of SD, the variability of the process – here shown by the large changes month to month – also dropped significantly.

How this was done deserves some description and explanation.

First, we need to look at the steps in the distribution process. Army customers in Bosnia put their requisitions into the DoD system, where they are directed to the appropriate inventory manager, after which a materiel release order is sent to the designated distribution center. The materiel is shipped from the distribution center to a consolidation point, collocated with the Susquehanna SDP,²¹ where the cargo is mounted on an airliftable pallet. The pallets are delivered by commercial truck the 120 miles from Susquehanna to Dover (DE) Air Force Base,

²¹In addition to being a major inventory storage point, the SDPs also have “CCPs,” or containerization/consolidation points, which gather materiel from various locations and consolidate them into airliftable pallets and ocean-carried 40-foot containers. Much of the materiel they consolidate comes from the SDP bins themselves, but much also comes from other DLA distribution centers, from General Services Administration depots, via direct shipment from vendors and manufacturers, and from many other sources as well.

where they are staged for the flight to Ramstein Air Base in Germany. Once at Ramstein, cargo and distribution managers determine the mode of shipment—e.g., Air Force C-130 plane or commercial truck—to move the pallet to Tuzla, Bosnia and the requisitioning customer, who posts a receipt acknowledgement to the wholesale system, thus closing the cycle.

What were the problems in the process before SD, and what did SD do to yield improvements?

Pre-SD, distribution to Bosnia was harmed by shortfalls in the 3 S's—stock positioning, schedules, and synchronization. Because much of the materiel ordered by the Army in Bosnia was not located at Susquehanna, time was lost waiting for it to be shipped from around the country to the consolidation point at Susquehanna. In addition, truck movements weren't scheduled, in that the truck used to drive pallets to Dover did not come to Susquehanna at a set time, nor was it required to arrive at Dover at any specific time (its contract called for delivery any time within a 27-hour window). Finally, there was little or no synchronization of movements: departure from Dover was not linked to the pallet's arrival there, nor was onward movement from Ramstein tied to the arrival of the pallet from the United States.

Improvements to the process flowed precisely from attacking these problems.²²

One important change was to sharpen the truck delivery schedule from the original 27-hour window to a four-hour window. Dover hold time was also reduced substantially, largely through process improvements. The overarching goal was to load the pallet on the next flight out (typically, the Atlantic Express mission departing at approximately midnight local time). To accomplish that, Susquehanna would alert load planners at Dover that pallets were on their way.

²²The following only discusses the schedules and synchronization. Bosnia benefited greatly from improved stock positioning as well, but in a way not visible in the figure. As DLA moved to improve service through better stock positioning in 2001, it succeeded not only in putting more stock at the SDPs, but also in putting some of the highest-demand items in theater distribution platforms (TDPs) to better support forces outside the United States. A principal TDP is at Germersheim, Germany. By the end of 2001, Bosnia was receiving up to one-third of its shipments from this location, at distribution times well under those from the United States, as shown on the chart. Because more of Bosnia's support came locally, improved stock positioning at SDPs had very little effect on the improved performance discussed here. To minimize inventory and related costs, while also reducing transportation costs and maximizing responsiveness to customers, DLA forward positioned only the highest-demand items to the Germersheim facility. Thus, the majority of shipments, mainly involving lower-demand items (but many different types of items) still came from U.S. locations, principally Susquehanna.

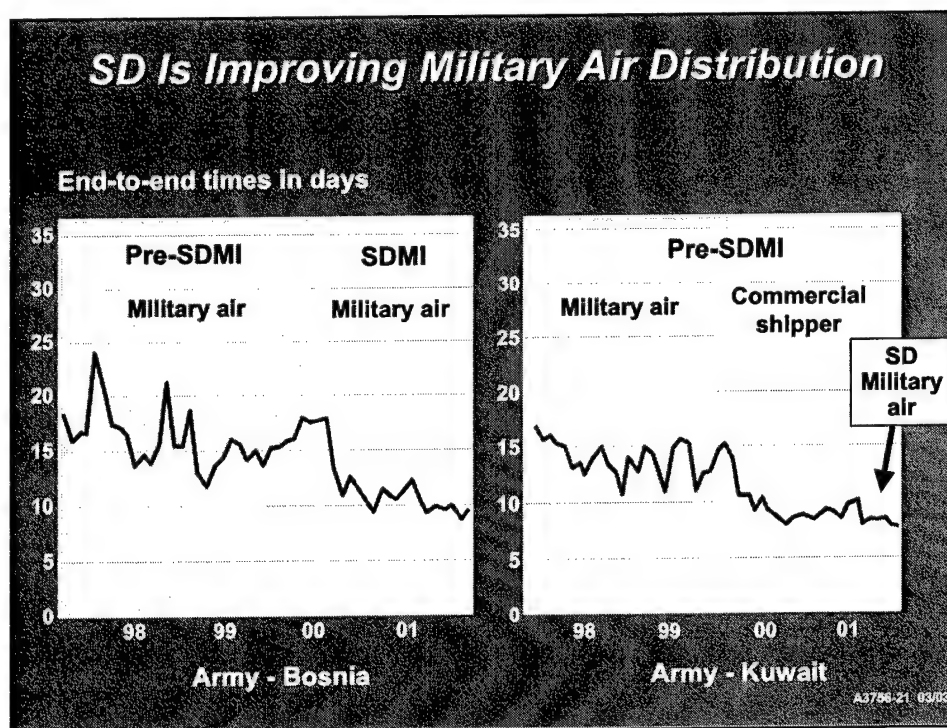
Truck departures from Susquehanna and arrival at Dover were timed to allow sufficient time for final weight checking and other preparation before being loaded on the next Atlantic Express flight.

Once in theater, synchronization was improved largely through the efforts of a new organization created by the European Command to enhance management of the process. The Theater Distribution Management Center (TDMC) has played a vital role in pursuing synchronization of scheduled movements and emphasizing movement versus holding of pallets. The TDMC, with access to the same distributed database as Dover,²³ has the same visibility of onward-bound pallets as Dover. It uses that information to make transportation mode decisions aimed at minimizing pallet hold time at Ramstein. It makes aggregate calculations of the volume of inbound cargo for a given window of time and compares that to allocated airlift capability to Tuzla in the same time period. If insufficient airlift capacity is available for all Tuzla-bound cargo, the TDMC will have those pallets be designated for surface movement to Tuzla by Brown and Root trucks, under the rubric of Eagle Express. Given the two-hour flight time to Tuzla versus the 30-hour surface movement time, preference is given to movement by air whenever possible, but not at the cost of holding the pallets at the port longer than it would take to deliver them by truck.

The success of the theater portion was therefore actually twofold. First was the overall reduction of the length and variability of the process, which was substantially driven by improvements in the theater part of the distribution process. The second great success of this effort was in achieving this better performance while substantially substituting surface movement for air. In the baseline period, 85 percent of Tuzla-bound pallets were moved in the theater by air (C-130 and weekly C-17s). In the SD implementation period, air-carried pallets dropped to under 50 percent—and yet service to the customer markedly improved. The benefits from this improvement have ripple effects. The weekly C-17 mission to Tuzla was canceled as no longer vital; C-130s previously flown to

²³Both locations (and most military aerial ports) have the Global Air Transportation Execution System (GATES) as their management tool. When, for example, Dover receives pallets from Susquehanna and checks them into the GATES system, Ramstein Air Base in Germany (home of the TDMC) would “see” the pallets after the next information system update. During the initial months of the implementation, a remote GATES terminal was set up at Susquehanna and manned by reserve Air Force personnel, so Dover load planners could “see” the pallet as it departed the CCP. Later, Susquehanna informed Dover of oncoming pallets via fax and email. One goal of SD is to create transparency of information across process owners by linking information systems, for example, tying GATES to DLA’s Distribution Standard System (DSS).

support Tuzla were released for other training missions in Europe, and later on the squadron was reduced from eight to six planes as its workload dropped, resulting in fewer Air Force personnel deployed from the United States to Europe.



The story of SD improvements for forces deployed to Kuwait is similar to that of Bosnia in many ways, but with an interesting twist. The Army's major supply activity in Kuwait was also having its materiel shipped from the United States like the Army forces in Bosnia. As seen in the right-hand figure on the chart above, end-to-end distribution time to Kuwait via military air in 1998-1999 showed the same type of variability as Bosnia, although the extent of variability and overall averages were both better than what the Army experienced in Bosnia.

However, the length and variability still were unsatisfactory to the Army forces in Kuwait, who in September 1999 effected a change in service type. The Army worked with DLA and TRANSCOM to contract with a commercial firm to pick up the pallets from the Susquehanna SDP and deliver them to Kuwait according to negotiated times and prices. The resulting improvements brought about by this change are clear in the right side of the figure.

For various reasons, leaders of SD and in Central Command (of which the Army forces in Kuwait are a part) decided it would be better if Kuwait-bound cargo were once again carried by military air rather than the commercial firm, but only if service and price were not harmed. After discussions and the development of a plan of operations, Kuwait cargo reverted to military air in April 2001.

Using the same techniques as in Bosnia, SD produced similar benefits for Army forces in Kuwait.²⁴ Here, military air performance matched (or slightly outperformed) the commercial carrier's performance as a result of the redirecting of cargo.

However, one of the concerns expressed by logisticians in Central Command in the pre-April negotiations is not reflected in the chart above, and that is the sustainability and dependability of military air service. Unlike commercial carriers, which are bound by a contract, military air service is in part determined by the priority of the customer. The limited amount of airlift is made available by prioritizations that are out of customer control. Thus, whenever in the past there had been a higher priority—a contingency, a major exercise, a large-scale presidential trip—customers might lose their high airlift allocation and suffer longer times (which in part accounts for the month-to-month variability in the pre-SD period on the chart). The question raised by some in Central Command was whether SD would make a difference in this regard and be able to deliver stable and dependable support no matter what else was happening. That is, would it accomplish “time definite delivery” in peace and war?

The chart above does not truly answer that question, because of the limited time period depicted (April to August 2001). But the final section of this document will address that and the wartime issue by examining what happened after September 11, both for service to Kuwait and for all the customers of military air around the world.

²⁴As was the case with Bosnia, improved stockage consolidation had no effect on the times shown in the chart, but for a different reason; in fact, improved stock consolidation *did* lead to reduced costs for supporting Kuwait. To meet the customer's needs for responsiveness, support to Kuwait was set up whereby only the materiel stocked at Susquehanna was consolidated for shipment (either commercially or later by AMC); materiel resident at other distribution centers was shipped via premium service (Worldwide Express, the FedEx equivalent for overseas shipping). Improved stock positioning led to less use of this expensive shipping method, and more of the more cost-efficient consolidation mode. This dropped the cost of shipping to Kuwait by about two-thirds, and, because of improved synchronization and use of scheduled movements, the times shown in the figure matched premium service very closely. That is, increased stock consolidation led to lowered distribution costs to Kuwait with no cost to responsiveness.

Roadmap

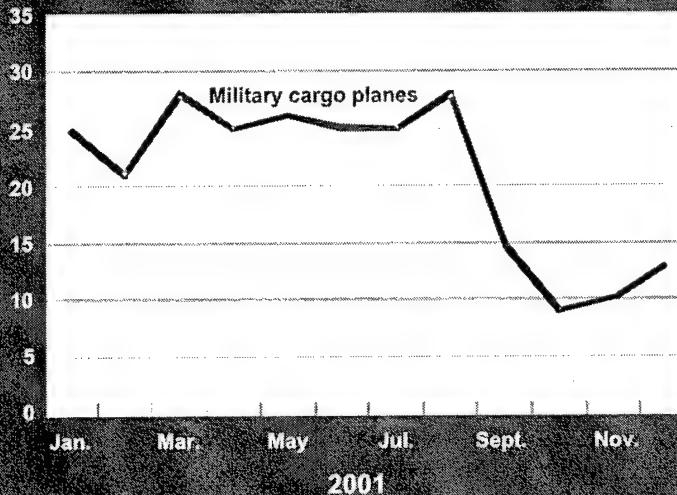
- The Strategic Distribution Management Program
- First results of SD's unfolding implementation
- The challenges of supporting Operation Enduring Freedom

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Operation Enduring Freedom created two challenges for global air distribution. The obvious one was to support a deployed force engaged in combat on the other side of the world from the supporting base and to do so with the responsiveness necessary to meet the force's needs. A less obvious, but also important, challenge was to maintain levels of support to U.S. forces around the globe whether or not they were directly involved in OEF operations.

Wartime Deployment Demands Took Away Military Aircraft Supporting Global Customers

Number of shipments in 1000s



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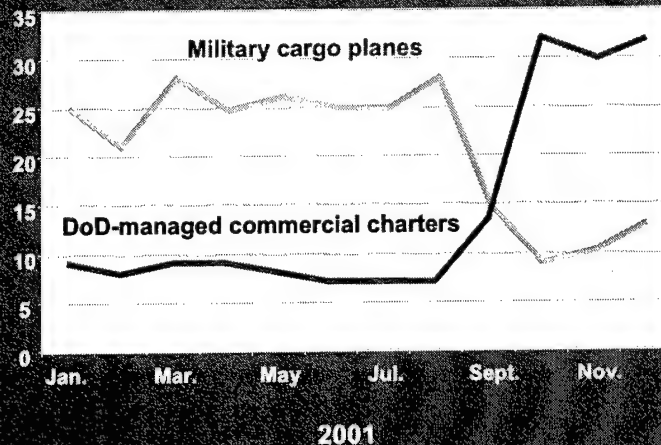
The chart above demonstrates what happened to military airlift following September 11, when virtually all the organic assets used by TRANSCOM's Air Mobility Command component to support "channel" missions²⁵ to its worldwide customers were removed to support OEF. The figure shows the volume of cargo (in terms of number of shipments carried) by organic aircraft each month throughout 2001. The total dropped off sharply in September and stayed at about a third of the pre-September 11 level.²⁶ That is, the organic means that were used to deliver more reliable service to customers in Bosnia, Kuwait, and elsewhere was no longer available.

²⁵A channel mission is a regular scheduled mission carrying sustainment cargo and personnel between two locations as laid out in yearly plans. Most channel missions are flown by organic Air Mobility Command aircraft (e.g., C-5, C-17) supplemented by chartered commercial aircraft as needed. In the remainder of this document we will be discussing channel missions exclusively.

²⁶The level would stay low well into 2002.

Transportation Command Replaced Military Planes with Commercial Aircraft

Number of shipments in 1000s



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Previous experience suggested that lower-priority customers would endure longer and less predictable waits for their cargo as the higher-priority missions were served first. But under SD, TRANSCOM and Air Mobility Command took steps to make sure that service levels would be maintained. The critical action was to find replacement airlift capability as soon as possible.

Some months prior to OEF, Air Mobility Command had instituted a set of policy procedures aimed at streamlining purchase of commercial charter capability off the open market. A trigger mechanism was set up to start the process if it became clear that service to customers would be affected by organic airlift being drawn away; approval procedures were expedited to allow Air Mobility Command buyers to charter commercial cargo planes as quickly as possible.²⁷

²⁷This is not to be confused with activation of the Civil Reserve Air Fleet (CRAF). Commercial air companies pledge specified numbers of cargo and passenger aircraft for use by DoD in wartime in exchange for guaranteed levels of peacetime business. Activating the CRAF requires directives from the Commander, U.S. Transportation Command, with approval by the Secretary of Defense. In this case, no such activation was required; instead, Air Mobility Command chartered planes already available on the open market. Later, in Operation Iraqi Freedom, CRAF also played little or no role in moving sustainment cargo to the theater of operations or other global destinations. The first (and smallest) stage of CRAF was activated by the Commander of TRANSCOM, but only for the purpose of deploying personnel to theater, not cargo. Throughout

These new procedures were relied upon during OEF. Immediately after September 11, of course, all aircraft were grounded for several days. Military airlifters were, in fact, able to get back into the air more quickly than commercial planes, and they resumed support to the worldwide customer base within two days of September 11. Meanwhile, planners at AMC awaited word as to what airlift requirement Central Command would place on them. By September 17, it became clear that virtually all organic airlift would be used to support the upcoming operation. However, the new procedure was then initiated, and within two days, commercial charters began falling in on the routes the organic aircraft had been flying.

The chart above shows how commercial charters (primarily 747s operated by charter companies such as Polar Air Cargo and Evergreen International) were able to take up the slack from the departed organic planes.²⁸

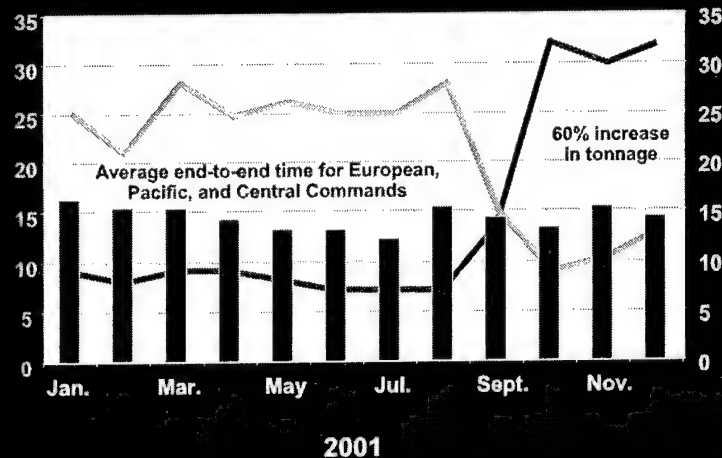
the course of operations, and despite a very large increase in cargo volume, sufficient commercial charter capability was available to maintain velocity around the world and to the theater.

²⁸One of the reasons the commercial alternative worked so smoothly in this case was that after September 11, commercial air traffic declined sharply, leaving plenty of spare cargo-carrying capacity on the open market. Whether this chartering arrangement will always work as well under all economic conditions is yet to be determined; however, see note 27 for its use in Operation Iraqi Freedom.

Strategic Management of Air Resources Successfully Maintained Customer Support

Number of shipments in 1000s

End-to-end time in days

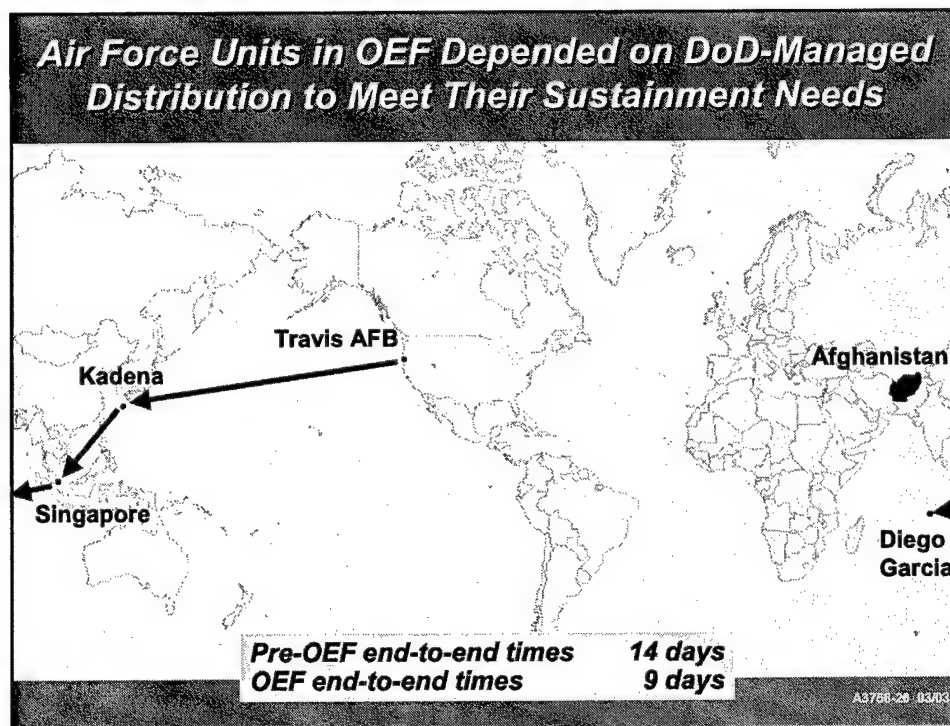


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This chart shows the impact of this move on support to the customer. The bars display the average end-to-end time for the three major commands (European, Pacific, and Central) averaged together, for cargo carried by Air Mobility Command. The chart demonstrates that despite the disruptions of September 11 and after, there was no noticeable impact on support to the customers. This was the case even with the major shift from organic to commercial aircraft, and even though the volume of materiel carried through these channels increased by 60 percent following September 11.

The addition of commercial charters to maintain customer service levels represented a net added cost for DoD transportation, but that was seen as an acceptable price to pay to eliminate any "shock" to the system and avoid disappointing customer expectations.

Ultimately, it turned out that adding the level of velocity to channel flights was vital not only to DoD's worldwide customer base, but also to sustaining the forces engaged in OEF as well. As will be discussed in the next few charts, velocity to OEF forces could not be differentiated from velocity to all other customers.



The next few charts will examine air distribution support to the three major sets of forces involved in OEF: Air Force bombers operating out of Diego Garcia (in the Indian Ocean), Navy aircraft carriers operating out of the Arabian Sea with support bases in the Persian Gulf, and Army forces deployed to and operating out of Karshi Khanabad, Uzbekistan. Each had specific needs and offered an individual challenge to the global distribution system.

The first forces we discuss belonged to the Air Force. The center of gravity for Air Force operations in the first three months of OEF was Diego Garcia, where 18 B-1 and B-52 bombers were stationed. Although small in numbers, this handful of bombers had a major impact on operations. While flying only 10 percent of all combat missions, the bombers dropped close to 70 percent of all the ordnance in the bombing campaign that led to the overthrow of the Taliban regime in November.

Given the small size and criticality of the force, the Air Force's main need was for fast and reliable movement of critical parts to keep all the bombers as operational as possible.²⁹ In other situations, the Air Force's standard concept of support

²⁹This document focuses primarily on cargo movement through established channels, the primary one for the Air Force being Travis Air Force Base to Diego Garcia. This channel was

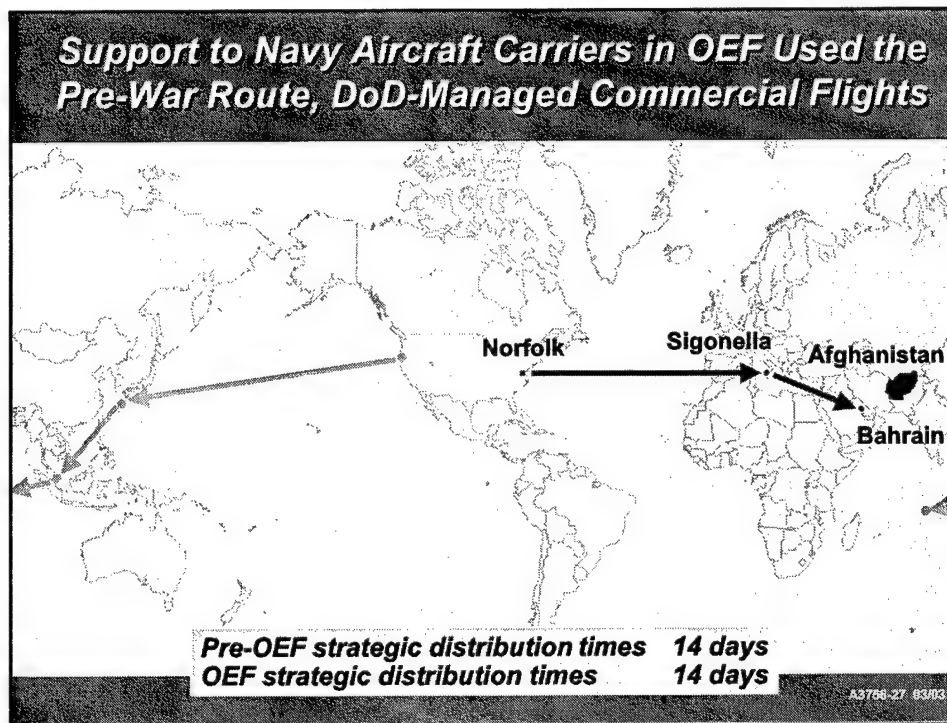
called for use of premium air commercial movement of needed spare parts via the commercial Worldwide Express mode, with oversized or hazardous materiel carried by Air Mobility Command. Although more expensive, the WWX mode delivered the speed and reliability the forces needed to maintain readiness.

In OEF, however, the commercial mode was not applicable: there is no commercial service to Diego Garcia. Instead, the Air Force turned to Air Mobility Command and TRANSCOM to determine how to deliver the level of speed and reliability it required. Consultations between Air Combat Command and Air Mobility Command led to agreement about the speed of service needed and created a basis for Air Mobility Command to lay out a route and a frequency from the U.S. home base to Diego Garcia that would meet Air Force requirements. (The basic international route structure is shown above.)

Because the amount of cargo for Diego Garcia was limited, it would have been prohibitively expensive to fly directly from the United States to the Indian Ocean. Instead, Air Force OEF cargo was placed in the standard channel traffic departing from Travis Air Force Base along the "Mid-Pacific" route going to Kadena, Okinawa.³⁰ The OEF cargo was offloaded and transferred to planes flying a route connecting Okinawa, Singapore, and Diego Garcia. By synchronizing each step and following SD principles, Air Mobility Command was able to minimize hold times at Travis and Okinawa and to achieve overall times to Diego Garcia that compared favorably to WWX performance. It should be noted that this success depended in large part on the use of commercial charters to augment the military fleet to support the global customer base. Because most of the organic aircraft had been pulled away to support deployment, the vast majority of Air Force OEF cargo was carried at least part of the way between the United States and Diego Garcia on these commercial charters; in the first three months of OEF, almost 90 percent of Air Force shipments went at least one leg on a commercial charter.

dominated by repair parts. Other vital commodities, such as munitions and fuel, were delivered outside the channel route structure. For example, cargo planes were assigned (or chartered) to fly munitions replenishments, such as JDAM kits, directly from Ogden (Utah) Air Logistics Center to Diego Garcia.

³⁰The Mid-Pacific route traditionally goes to Yokota Air Base (Japan) first; however, runway work at Yokota led to the rerouting of these channel flights.



Due to the global reach of its forces, the Navy was able, from the earliest moments of OEF, to apply large, sustained combat force over Afghanistan from attack aircraft launched from aircraft carriers in the Arabian Sea. Over the course of the operation, the Navy rotated four carrier battle groups in the region at any one time, including the *USS Carl Vinson*, *John C. Stennis*, *Kitty Hawk*, *Enterprise*, and *Theodore Roosevelt*.

The Navy's distribution needs were significantly different from those of the Air Force. For the Navy, OEF did not call for a new sustainment channel for its forces, nor necessarily a heightened level of speed. The Navy operates within this area all the time and has a well-developed base of operations in the Persian Gulf. The Navy's main concern was to maintain at least the traditional level of support coming from the United States. There were two possible reasons for concern. The first was that by moving four carrier battle groups into the region (versus the standard one group) and flying more intense operations, the Navy was seeing a great increase in the volume of materiel flowing through the channel to the Persian Gulf. At the same time, the organic assets available to

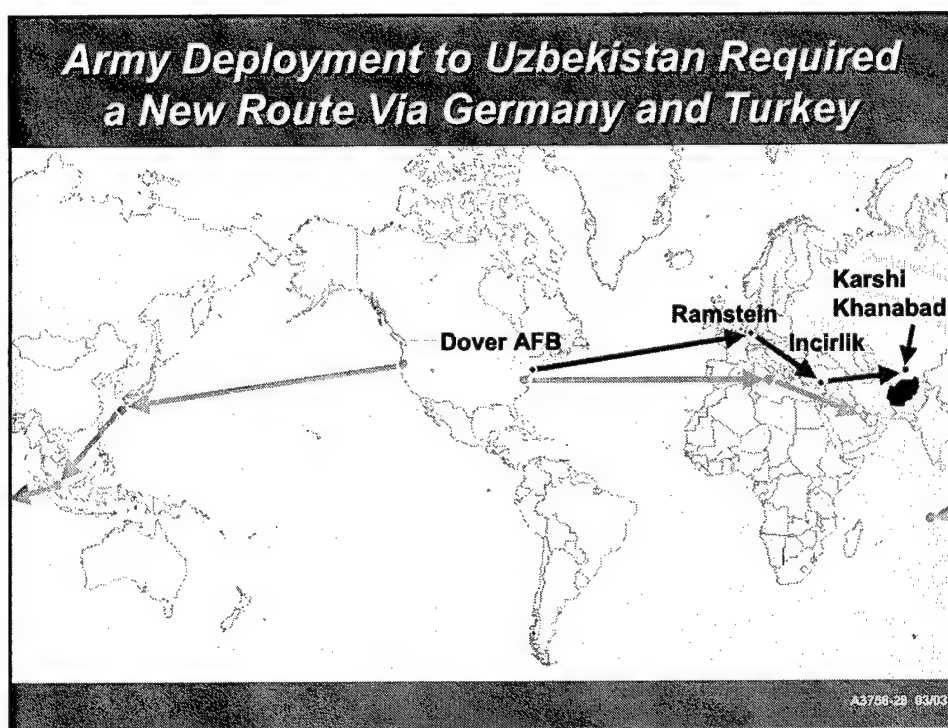
handle that increased flow were limited, with many aircraft taken away to handle other vital wartime missions.³¹

The answer in this case was to increase reliance on commercial charters. Cargo to the Persian Gulf traditionally flows from Norfolk Naval Air Station through Italy to the Gulf (see the figure above); unlike many other channels, this route has typically relied on commercial chartered aircraft for 50 percent or more of the lift capability. Most weeks, service from Norfolk on to Bahrain called for two commercial charters (typically a 747 and a DC-8) and two military aircraft (usually a C-5 and a C-141). The more than tripling of volume during OEF was met by increasing the number of both commercial and military flights to the region, but relying most heavily on the large 747 workhorse cargo planes. The schedule for the week of October 20, for example, saw five 747 flights from Norfolk, along with a commercial DC-8, and five military aircraft departures (three C-5s and two C-141s). Because of the large carrying capacity of the 747s, total cargo carried by commercials went from 463 tons in June–August 2001 to over 2,000 tons in October–December, compared to increases from 333 to 727 tons for military aircraft.

The end result of this surge in capacity was that peacetime responsiveness was maintained even as demand more than tripled. The “strategic distribution” time was unchanged during OEF compared to what it had been previously.³²

³¹Total cargo carried by Air Mobility Command to the Gulf increased about 340 percent from the June–August 2001 period to October–December 2001, roughly reflecting the increase from the typical one or two carrier battle groups in the region in peace to the four battle groups for all or part of the first three months of OEF.

³²We do not report end-to-end times here, due to peculiarities of calculating times for the Navy. Because Navy ships engaged in operations are of course deployed at sea, the Navy receives cargo from the United States at shore locations, and then waits for the ship to call the cargo forward. The Navy moves cargo forward through its own organic means, such as by using helicopters and special supply aircraft to resupply aircraft carriers, and ships to move cargo to other Navy vessels. There are also issues in how Navy ships submit their requisitions, with substantial variability among different ships. Because of this Navy-induced variability and our desire to focus on how the strategic distribution performed, we here limit the measurement to “strategic distribution time,” measured from arrival of the requisition in the United States to arrival of the cargo at the theater port.



In the first three months of OEF, the Army deployed elements of its special operations forces and units from the 10th Mountain Division to Uzbekistan, using the Karshi Khanabad air base as a platform to launch operations into Afghanistan. The major supply activity deployed was the 526th Forward Support Battalion (Special Operations) out of Fort Bragg, North Carolina.

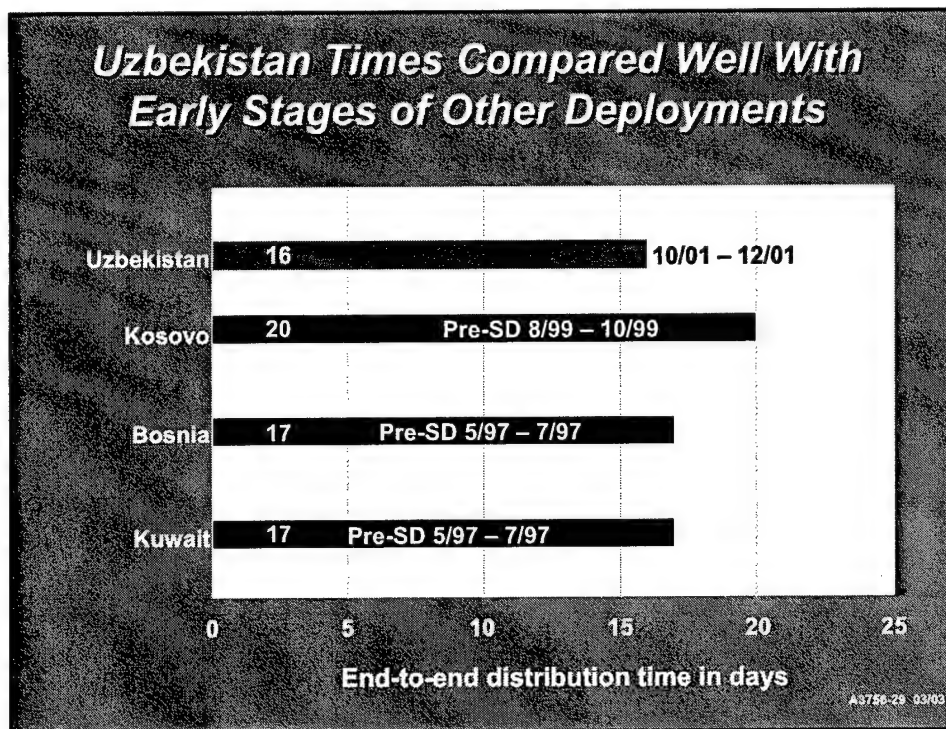
Supporting forces in Uzbekistan was a challenge in several ways: Karshi Khanabad was a bare-bones base with no history of U.S. deployments and was located far from established U.S. support bases. In addition, deploying forces carried limited supplies and so were especially dependent on fast, reliable distribution from the U.S. support base.

The major means of sustainment support to Uzbekistan in the first months of OEF was the same model used to supply Bosnia and Kuwait. Improved stock positioning meant that more of the materiel ordered by Army forces in Uzbekistan came from its SDP at Susquehanna, PA.³³ Pallets built at the CCP at Susquehanna moved via scheduled truck to Dover Air Force Base and then entered the channel flow from Dover to Ramstein Air Base in Germany, from

³³Susquehanna supplied 66 percent of Uzbekistan shipments; forward-positioned stock at Gernersheim, Germany accounted for another 5 percent.

which they either continued on to or were transloaded to another flight to Incirlik (Turkey) Air Base. The final leg, typically by Air Mobility Command C-17, took the pallets from Incirlik to Karshi Khanabad.³⁴

³⁴Eighty percent of the Uzbekistan-bound pallets left Dover on commercial charter aircraft, the other 20 percent on military airplanes. At Ramstein, military aircraft carried two-thirds of the pallets on to Incirlik, and 100 percent of the pallets from Incirlik to Karshi Khanabad.



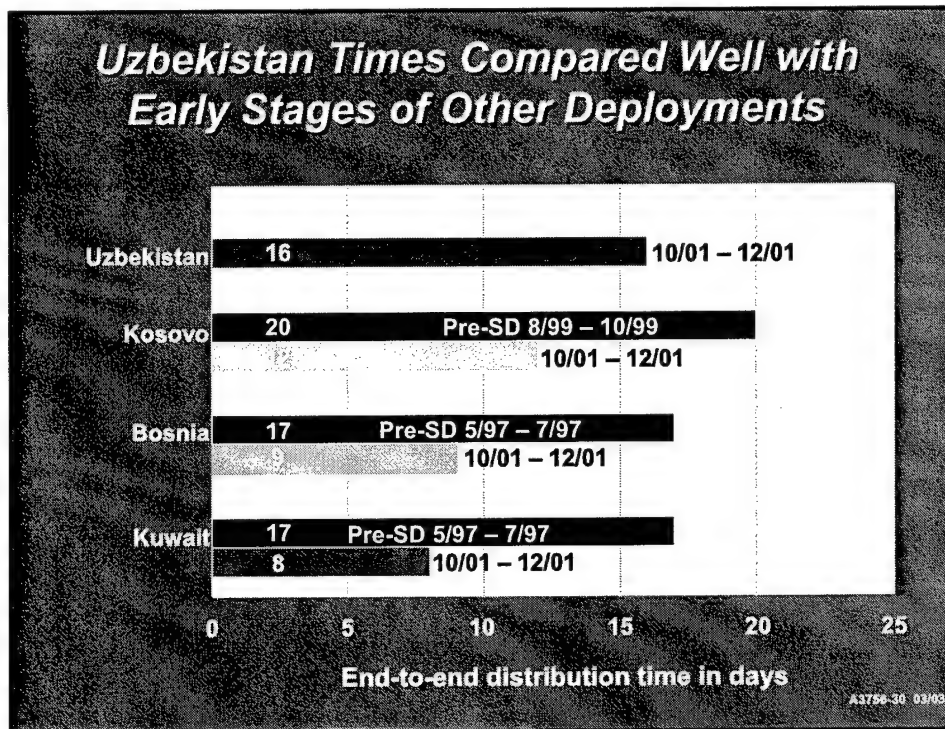
This chart shows average end-to-end distribution time for Army forces deployed to Karshi Khanabad for the period October-December 2001. Unlike the previous charts, this chart shows no comparison of before and after: there was no “before” for Uzbekistan shipments. Times, from request date to receipt, averaged about 16 days. What, then, is the relevant yardstick for comparison?³⁵ One way of putting these times into perspective is to show system performance to other recent Army deployments using the same distribution method, at roughly equivalent stages of their deployment. RAND, as part of its support for the Army’s VM initiative, has tracked such performance since 1995. The chart shows what other Army deployments to Kosovo, Bosnia, and Kuwait experienced in the first months after setting up operations.³⁶

³⁵In March, forces in Uzbekistan started receiving premium air shipments, or WWX. End-to-end distribution times for March and April averaged 14 days, at considerably higher costs (the minimum price, for up to a one-pound shipment, was almost \$40).

³⁶The starting point was not necessarily when Army forces first arrived, but rather when the organic Army supply support activity, attached to a Forward Support Battalion, was first established; such a comparison tends to match the deployment of the 526th Forward Support Battalion to Uzbekistan. Of course, the latter was part of the first Army elements to deploy, which was not the case for the other deployments.

The chart shows that support to the Uzbekistan deployment compared favorably to other Army operations. Despite the much greater distance, more cargo "touches," and channel congestion, end-to-end times were better to Uzbekistan than to the other destinations.³⁷

³⁷Cargo for Kosovo, Bosnia, and Kuwait had one possible transload: at Ramstein for Kuwait and Bosnia (the latter to theater air), or at Sigonella en route to Skopje, Macedonia, for the Kosovo deployment. Uzbekistan-bound cargo most often would transload at Ramstein and then transload again at Incirlik. There were also some delays due to port congestion during the surge for OEF, mostly affecting Ramstein and Incirlik operations. Finally, there were early startup problems for the supply activity in Uzbekistan: shortfalls in supply management computers and space to store incoming cargo led to delays at both the requisition submission and receipt processing steps.



One reason times to Uzbekistan compared so favorably to the other deployments, despite the obstacles (see footnote 37), was that the performance shown for the other deployments occurred during the pre-SD period, before process improvements had been made. This chart shows what a latter period looked like for Kosovo, Bosnia, and Kuwait: the end-to-end times for the same Army units during the first three months of OEF. The chart illustrates the dramatic changes in customer support made by SD for Bosnia and Kuwait (and, via another initiative not discussed in this document, for Kosovo).

The chart shows the level of improvement possible from applying SD principles (as well as working out the kinks inevitable in the early stages of a deployment) and, by implication, the possible improvement of service to forces deployed even farther away in Uzbekistan and Afghanistan.

Implementation of Strategic Distribution Is Accelerating

- **SD has proven that a strategic partnership works**
 - New leadership at Transportation Command and Defense Logistics Agency have fully embraced the "Strategic Distribution Management" concept
 - DLA estimates five year savings of \$120m from scheduled trucks and stock positioning
 - Better use of organic lift reduces cost of commercial shipping
 - Successes to date provide impetus for future expansion
- **RAND is continuing to support all aspects of improvement efforts**
 - Enhance distribution database and transfer to DoD
 - Provide analysis to support process improvement
 - Generate implementable actions to help integrate all stockage and air/land/sea distribution activities

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Successful business ventures in process improvement, such as "Six Sigma" made famous by Motorola and more recently GE, derive much of their power from becoming embedded in the firm's normal way of operating. The Army has followed this model by maintaining VM as a permanent endeavor, having pursued process improvement under the same rubric from 1995 to 2002.³⁸ SDMI matured into "Strategic Distribution" (SD). As the Commander of TRANSCOM has said, this is no longer an initiative: Strategic Distribution (following the principles first laid down under SD) is now the way of doing business.

Because military organizations, unlike private firms, constantly turn over their senior leadership, one of the greatest challenges to maintaining commitment and momentum in an effort like this occurs when the leadership that started the initiative gives way to successors. In the Army's VM initiative, the problem was dealt with by forming a broad-based coalition of Army logistics generals. Then when one leader departed and a new one came on, there was a continuing "institutional memory" of the effort among the leadership, and often the remaining leaders helped "socialize" the newcomers, while the newcomers often brought along good ideas and a healthy skepticism.

³⁸Until the name was changed to "Distribution Management" (DM).

SD has also forged a coalition of leaders, including top leaders at TRANSCOM and DLA, and expanding at times to bring in leaders from the services, the Combatant Commanders, and OSD. A recent critical challenge was to prove to the new leaders of both DLA and TRANSCOM the worth of SD and provide justification for continuing. In fact, both the new commander of DLA and the new Combatant Commander of TRANSCOM have stated their full support of SD and, if anything, are pressing for more rapid implementation of the SD principles.

As the bullets on the chart lay out, SD is proving its worth via both cost savings and improved responsiveness to the customer. The increased use of scheduled trucking in the United States and forward stock positioning of critical, fast-moving items to theaters outside the United States is expected to save over \$120 million over the next five years. The rationalization of air modal choices—using organic resources whenever feasible—will reduce taxpayer dollars flowing out of the Department of Defense. Faster and more reliable distribution times will lower customer inventory requirements, with concomitant potential for savings there.

Distribution to OEF forces should be judged a success, as this document has attempted to argue; however, the Defense distribution system still falls short of the strategic vision laid out earlier. SD teams, supported with RAND analysis, are continuing to push forward on implementing the 3 S's by seeking ways to further consolidate inventory, expand scheduled truck networks, leverage forward positioning of stock in major theaters, open new improvement initiatives in the Pacific and elsewhere, and work more closely with the services to seek alignment of stockage and distribution policies for all DoD inventory carried at the wholesale level.

AFTER THE FALL OF THE TALIBAN

What was first called the Strategic Distribution Management Initiative, later renamed simply Strategic Distribution, was born in 2000, in a very different world. On September 11, 2001, as for so much else, the place of SD changed from a structure focused overwhelmingly on making changes in a mostly stable peacetime environment to a tool for helping DoD support armed forces at war. This document described how that system was applied successfully to the challenging demands of the first three months of Operation Enduring Freedom. Since December 2001, the pace of demands on worldwide distribution has only increased.

Support to forces employed in and around Afghanistan increased after December 2001 as the theater structure matured and forces dug in for a longer stay and a sustained operation. Not long after that began a ramp-up of forces deploying to Kuwait and the Persian Gulf region for a possible operation against Iraq that became reality on March 17, 2003. Following cessation of major combat operations in Iraq, U.S. forces began stabilization activities that also promised to last for some time. In the meantime, the pace of activity has increased as well in various places around the world, such as the Philippines, Yemen, Djibouti, and so on, as the United States pursues the Global War on Terrorism. As President Bush declared in May 2003, Operation Iraqi Freedom was just one more battle in an ongoing war.

If true, there will be little breathing space for the Defense distribution system. It must seek to improve its ability to deliver cost-effective, fast, and reliable support to a global U.S. presence by attacking poor performing and non-value-adding processes while at the same time operating those processes at near-peak load. In Operation Enduring Freedom the Defense distribution system met that test; in a future report we will document how well it performed in operations since then.

The nature of this new world is likely to change some of the areas of greatest importance.

- Integrating the strategic elements of the Defense distribution system with theater processes will become more prominent.
- Developing an integrated management to control the entire distribution process will become yet more critical.

- Balancing the needs for deployment and sustainment across shared resources (ports, aircraft, etc.) will become more pressing.
- Improving the quality of in-transit visibility, such as through the use of radio frequency tags, will help deployed forces better manage their needs.
- The continued reliance on commercial sources to carry cargo from Air Mobility Command ports will necessitate clearer policies on the division of labor between organic and commercial craft and how to manage CRAF.
- The fact of U.S. forces increasingly dispersed across the globe suggests the need for expanding our view of stock positioning and balancing the usefulness of U.S.-based stocks at Strategic Distribution Platforms and theater-based stocks.

Whatever challenges lie ahead, however, the test posed by this first conflict of the 21st century was one that the Defense distribution system passed with flying colors.